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STUDIES OF
SOUTHERN CROSSINGS
OF
SAN FRANCISCO BAY

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DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS
DEPARTMENT OF PUBLIC WORKS · STATE OF CALIFORNIA

JANUARY 1959

A REPORT

TO THE

DEPARTMENT OF PUBLIC WORKS

ON THE

STUDIES OF

S O U T H E R N C R O S S I N G S

OF

SAN FRANCISCO BAY

January 1959

Division of San Francisco Bay Toll Crossings
Department of Public Works
State of California

STATE OF CALIFORNIA

Edmund G. Brown
Governor

DEPARTMENT OF PUBLIC WORKS

Robert B. Bradford
Director

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DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS

N. C. Raab
Projects Engineer

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ROBERT B. BRADFORD
DIRECTOR

Edmund G. Brown
Governor

STATE OF CALIFORNIA

Department of Public Works

SACRAMENTO

Honorable Edmund G. Brown, Governor of California,
and members of the California Toll Bridge Authority

Gentlemen:

There is transmitted herewith a report, prepared by the Division of San Francisco Bay Toll Crossings, presenting a summary of all previous studies heretofore made by various governmental agencies on a southern crossing of San Francisco Bay. Also contained therein is a discussion on the present financial status of all State-owned toll bridges and of the powers of the Authority in relation to a southern crossing and a rapid transit tube.

The report was prepared in compliance with a recommendation adopted by the California Toll Bridge Authority at its meeting of April 30, 1958, and as authorized by Chapter 3, Statutes of 1958.

It is my pleasure to submit this report to the members of the Authority for their consideration.

Respectfully submitted,

Robert B. Bradford

ROBERT B. BRADFORD
Director of Public Works

N. C. RAAB
PROJECTS ENGINEER

EDMUND G. BROWN
GOVERNOR

ROBERT B. BRAD
DIRECTOR

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
Division of San Francisco Bay Toll Crossings
151 FREMONT STREET
SAN FRANCISCO 5, CALIFORNIA

PLEASE REFER
TO FILE No.

Honorable Robert B. Bradford
Director of Public Works
Sacramento, California

Dear Sir:

It is my pleasure to submit herewith our report on all of the previous studies made for a southern crossing of San Francisco Bay by the various governmental agencies.

The report was prepared pursuant to a recommendation adopted by the California Toll Bridge Authority at its meeting of April 30, 1958, excerpts of which are appended herein, and the Department's directive of October 8, 1958.

Funds for this study were provided by Chapter 3, Statutes of 1958, which authorized the Department of Public Works to use the unexpended balance of the Southern Crossing Engineering Fund. This Engineering Fund, in the amount of $1,500,000, was established from the sale of $3,000,000 of 1951 Refunding and Improvement Toll Bridge Revenue Bonds, Series D, San Francisco-Oakland Bay Bridge.

Respectfully submitted,

N. C. RAAB
Projects Engineer and
Chief of Division

TABLE OF CONTENTS

		Page
CHAPTER I	INTRODUCTION	I- 1
	Background	I- 2
	Developments	I- 3
	History	I- 5
CHAPTER II	SUMMARY OF PREVIOUS REPORTS	II- 1
	Transbay Bridge, San Francisco Board of Engineers, May 1927	II- 2
	Conclusions	II- 2
	Comments	II- 2
	San Francisco Bay Bridge, Hoover-Young San Francisco Bay Bridge Commission, August 1930	II- 4
	Conclusions and Recommendations	II- 4
	Comments	II- 6
	Bridge from Hunter Point to Bay Farm Island Across San Francisco Bay, Joint Army-Navy Board, July 1941	II- 6
	Conclusions	II- 8
	Comment	II- 8
	An Additional Crossing of San Francisco Bay, Joint Army-Navy Board, January 1947	II- 8
	Findings	II-10
	Conclusions	II-12
	Recommendations	II-12
	Comments	II-12
	Preliminary Studies for an Additional Bridge Across San Francisco Bay, Department of Public Works, January 1947	II-12
	Conclusions	II-15
	Locations via Yerba Buena Island	II-15
	South Bay Locations	II-16
	Recommendation	II-17
	Comments	II-17
	Additional Toll Crossings of San Francisco Bay, Division of San Francisco Bay Toll Crossings, November 1948	II-18
	Conclusion	II-19
	Comments	II-21
	Relief of Congestion on Transbay Crossings, Assembly Interim Fact Finding Committee, June 1949	II-21
	Conclusions	II-21
	Recommendations	II-22
	Comments	II-22

TABLE OF CONTENTS - Continued

		Page
CHAPTER II	SUMMARY OF PREVIOUS REPORTS, Cont'd.	
	Additional Toll Crossings of San Francisco Bay as Proposed by Consultants to Assembly Interim Committee, Division of San Francisco Bay Toll Crossings, October 1949	II-22
	Conclusions	II-23
	Comments	II-23
	Alterations and Approaches to the San Francisco-Oakland Bay Bridge as Suggested by San Francisco Bay Area Council, Division of San Francisco Bay Toll Crossings, October 1949	II-24
	Recommendations	II-25
	Comments	II-25
	Development of San Francisco Bay Region, Assembly Consultants, International Engineering Company, John L. Savage, January 1951	II-27
	Conclusions	II-27
	Comments	II-29
	Barriers in the San Francisco Bay System, Division of Water Resources, March 1955	II-29
	Findings	II-29
	Conclusions	II-30
	Recommendations	II-31
	Comments	II-31
	Southern Crossing of San Francisco Bay, Division of San Francisco Bay Toll Crossings, December 1955	II-31
	Progress Report, December 1954	II-32
	Project Report, December 1955	II-34
	Comments	II-35
	Southern Crossing of San Francisco Bay, Division of San Francisco Bay Toll Crossings, March 1956	II-35
	Comments	II-35
	Southern Crossing of San Francisco Bay, Division of San Francisco Bay Toll Crossings, October 1956	II-35
	Conclusions	II-36
	Comments	II-36

TABLE OF CONTENTS - Continued

		Page
CHAPTER II	SUMMARY OF PREVIOUS REPORTS, Cont'd.	
	Southern Crossing of San Francisco Bay, Division of San Francisco Bay Toll Crossings, December 1957	II-37
	Conclusions	II-37
	Comments	II-37
	Reconstruction of the San Francisco-Oakland Bay Bridge, Division of San Francisco Bay Toll Crossings, March 1957	II-38
	Conclusions	II-38
	Comments	II-39
	Improvements to the San Mateo-Hayward Bridge, Division of San Francisco Bay Toll Crossings, October 1958	II-40
	Conclusions	II-41
	Recommendation	II-42
	Transbay Tube, Consultants for San Francisco Bay Area Rapid Transit District, July 1958	II-42
	Conclusions	II-44
	Comments	II-44
CHAPTER III	PRESENT FINANCIAL STATUS STATE-OWNED TOLL BRIDGES	III- 1
	Present Financial Status	III- 2
	Liabilities	III- 3
	Existing Reserves	III- 5
	Feasibility of Refinancing	III- 6
	San Mateo-Hayward and Dumbarton Bridges	III- 6
	Richmond-San Rafael Bridge	III- 7
	Additional Carquinez Bridge	III- 8
	Benicia-Martinez Bridge	III- 9
	Refinancing Possibilities	III- 9
CHAPTER IV	LEGAL	IV- 1
	Southern Crossing	IV- 1
	General Powers of the Authority and Limitations Thereon	IV- 1
	Federal Financing	IV- 4
	Summary	IV- 5

TABLE OF CONTENTS - Continued

		Page
CHAPTER V	COMPETITION OF BAY CROSSINGS	V- 1
CHAPTER VI	TRAFFIC	VI- 1
	History of Transbay Traffic	VI- 1
	San Francisco-Oakland Bay Bridge	VI- 1
	San Mateo-Hayward Bridge	VI- 4
	Dumbarton Bridge	VI- 6
	Southern Crossing	VI- 7
	Traffic Demand	VI-10
	Summary	VI-12
	Sources of Information	VI-13
CHAPTER VII	CONCLUSIONS	VII- 1
	Crossing Studies South of San Francisco-Oakland Bay Bridge	VII- 2
APPENDIX		
A	Chapter 3, Statutes of 1958	Append A-1
B	Extract of Minutes of California Toll Bridge Authority Meeting on April 30, 1958	Append B-1
C	Directive from Director of Public Works to Perform the Studies	Append C-1

LIST OF FIGURES

Figure No.	Title	Page No.
1	Board of Engineers, San Francisco, 1927	II- 3
2	Hoover-Young, San Francisco Bay Bridge Commission, 1930	II- 5
3	Joint Army-Navy Board, 1941	II- 7
4	Joint Army-Navy Board, 1947	II-11
5	Additional Bridge Across San Francisco Bay, California Department of Public Works, 1947	II-13
6	Additional Toll Crossings of San Francisco Bay, Division of San Francisco Bay Toll Crossings, 1948	II-20
7	San Francisco Bay Development, International Engineering Co., 1951	II-26
8	Barriers in San Francisco Bay, Division of Water Resources, 1955	II-28
9	Southern Crossing of San Francisco Bay, Division of San Francisco Bay Toll Crossings, 1955	II-33
10	Transbay Tube, San Francisco Bay Area Rapid Transit Commission, 1955	II-43
11	Bay Area Bridges Under Jurisdiction of California Toll Bridge Authority	II-46
12	Passenger Crossings of San Francisco Bay	VI- 3
13	Total Monthly Vehicular Traffic Bay Area Bridges	VI- 5
14	Traffic Diverted by New Crossing in 1964	VI- 9
15	Centers Transbay Traffic	VI-11
16	Previous Southern Crossing Studies Between Bay Bridge and San Mateo-Hayward Bridge	VII- 3

CHAPTER I

INTRODUCTION

Chapter 1056, Statutes of 1953 as amended, authorized and directed construction of a Southern Crossing from Army Street in San Francisco to Bay Farm Island in Alameda. However, Chapter 2316, Statutes of 1957, stated that if financing for the construction of the Southern Crossing had not been completed prior to July 1, 1958, all the legislation pertaining to that particular crossing should have no further force or effect. The crossing from Army Street to Bay Farm Island was found financially infeasible; therefore, the legislation pertaining to that particular crossing has lapsed.

Enactment of Senate Bill No. 19, Chapter 3, Statutes of 1958, authorized the use of the unexpended balance of the $1,500,000 Southern Crossing Engineering Fund, appropriated under Chapter 1056, Statutes of 1953, by the Department of Public Works for preparation of surveys and studies of an additional toll bridge or other toll highway crossing across the Bay of San Francisco between the County of Alameda on the east side of the Bay and the City and County of San Francisco or the County of San Mateo on the west side (See Appendix A).

The Toll Bridge Authority, on April 30, 1958, directed that an informational report be prepared summarizing all the studies heretofore made of a southern crossing, by the Department of Public Works and others, outlining the effects of new developments, military and civic, which might influence the

the conclusions of these reports; and including information as to the present financial situation of each bridge under the jurisdiction of the Authority. The effects of the reconstruction of the San Francisco-Oakland Bay Bridge and the probable reconstruction of the San Mateo-Hayward Bridge are also of importance (See Appendix B).

The Director of Public Works, on October 8, 1958, directed that the report be prepared in accordance with the action of the Authority and that provision for rail rapid transit facilities be considered and commented upon. (See Appendix C).

BACKGROUND

The Bay Area is the focus of commercial, industrial, cultural, and educational development in northern California, and the City of San Francisco is the most concentrated commercial center in the Bay Area; yet, being located on the extremity of a peninsula, it is relatively isolated by water from surrounding communities and tributary areas. Consequently, transbay crossings are matters of major concern. Passenger, automobile, and train ferries provided transbay transportation for many years, but since 1914 bridges for vehicular traffic have been seriously considered. Construction of the San Francisco-Oakland Bay Bridge eventually followed, and it was opened to traffic on November 12, 1936. From the time of opening, traffic has exceeded predictions and it has been apparent for several years that added vehicular capacity is necessary to keep pace

with the growth of the population and economy of the San Francisco Bay Area.

DEVELOPMENTS

With the passage of time the development of military installations, airports, and other civic improvements has eliminated many of the sites which were considered in previous studies for another crossing of the south arm of San Francisco Bay.

A few of the developments which affect the conclusions reached in previous reports, when viewed currently, are as follows:

1. The San Francisco-Oakland Bay Bridge was completed for highway traffic in 1936 and for interurban railway in 1939. During the war years, with the rationing of gasoline and rubber, the railway traffic reached its peak of 26 million revenue passengers in 1945. Thereafter patronage fell steadily until the abandonment of rail service in 1958. The space previously used for rails is now being converted to highway use, thus increasing the carrying capacity of the Bridge. Estimates of traffic indicate that the remodeled Bridge will not become seriously congested until 1972.

2. The State freeway system now provides extended approaches to all crossings of the Bay. This changes time and distance considerations as well as city street congestion for any particular crossing location.

3. Military bases in the Bay Area have changed considerably. The Alameda Naval Air Station has been extended into the tidelands at the west end of Alameda. As an adjunct to the Alameda Air Station, a naval seaplane landing area has been established over a vast area of the Bay south of Alameda. Not only the boundaries but the airplane glide paths extending beyond the boundaries must be considered when a high structure is contemplated. The large

Oakland Naval Supply Center and Oakland Army Terminal have been developed on the Oakland shoreline between the San Francisco-Oakland Bay Bridge and the Oakland Estuary. The shoals north of Yerba Buena Island have been reclaimed for use as Treasure Island Navy Base. Hunter Point which was originally the site of a private dry dock is now the location of San Francisco Naval Shipyard capable of construction and repair of the U. S. Navy's largest vessels. Naval and commercial ships are built and repaired at Bethlehem Shipyard in San Francisco near Potrero Point.

4. Civilian developments have kept pace with the military. Many harbor, industrial, and transportation improvements have been made along the waterfronts on both sides of the Bay. Both the San Francisco and Oakland International Airports have been expanded out into tidelands and longer runways are contemplated. The airplane glide paths must also be considered when locating bridge terminals.

5. A great amount of subaqueous exploration of the Bay has been performed, giving a better picture of conditions for crossing foundations.

In view of these developments neither a high level structure nor a low level crossing with a movable span appears acceptable between the San Francisco-Oakland Bay Bridge and the San Francisco Naval Shipyard at Hunter Point, since the former would interfere with Naval Air Station activities and the latter would interfere with access of Naval ships to the Shipyard. A low level six-lane vehicular crossing with subaqueous tubes under the ship channel was acceptable north of Hunter Point, but the Southern Crossing from Army Street to Bay Farm Island was reported upon as being financially infeasible. A subaqueous tube has been proposed for mass transit. Such a tube would require only two lanes and may prove to be less costly than a vehicular tube.

HISTORY

Serious planning for a crossing of the south arm of San Francisco Bay between San Francisco and Alameda Counties was begun in 1914 when Mr. Charles E. Fowler prepared plans for a series of cantilever spans from Telegraph Hill to Yerba Buena Island. This plan, along with several other proposals, was the subject of a hearing conducted by the War Department in 1916 in connection with applications for permits to construct crossings of San Francisco Bay. On April 1, 1917, the War Department denied permits to all applicants.

In 1921 the War Department stated that it was opposed to any low level bridge north of San Mateo and to any bridge north of Hunter Point.

A report to the General Bridge Committee of San Francisco, San Mateo, and Alameda Counties in 1921 recommended a tube and low level bridge combination from San Francisco to Alameda but nothing came of the proposal. Today this route passes through the Alameda Naval Air Station.

In 1925 two franchise applications for toll crossings between San Francisco and the Eastbay were filed with the San Francisco Board of Supervisors. An appeal to the War Department to set aside its 1921 ruling against any bridge north of Hunter Point was denied, and further hearings on this matter brought no change in the established policy.

Regardless of the War Department policy, 18 different applications in all were filed with the San Francisco

Supervisors in 1925 and 1926 for private toll crossings of the Bay. Due to the activity and competition for a franchise and the variety of proposals and differences of views resulting therefrom, the Supervisors appointed a Board of Engineers to study and report on the entire problem of Bay Crossings between the Counties of San Francisco and Alameda. This Board of Engineers made its report in 1927. Since then 18 additional principal reports on south Bay crossings have been rendered.

CHAPTER II

SUMMARY OF PREVIOUS REPORTS

Records reveal that as far back as 1856 plans of joining San Francisco with the east shore of the Bay were frequently the subject of news articles. In 1868, a combined railway and highway bridge between Hunter Point, the most easterly land in San Francisco, and Alameda, the most westerly land in the East Bay Region, was seriously considered. With the advent of the twentieth century, San Francisco and the East Bay cities had attained such size that the need for a connecting bridge was generally recognized.

Many reports by private or quasi-public organizations have been reviewed as well as those of various governmental agencies, with regard to the crossing of the Southern arm of San Francisco Bay connecting Alameda County with either San Francisco or San Mateo Counties on the west side of the Bay.

Nineteen of these latter studies are reported upon herein, two of which were published prior to the start of construction of the San Francisco-Oakland Bay Bridge in 1931. A report on modifications to the Bay Bridge to improve safety, by the Division of Highways in 1951, was not intended to add to transbay traffic capacity; therefore, it is not included in this summary. A chronological resume of the 19 reports with their conclusions and the comments of the Division of San Francisco Bay Toll Crossings follows:

TRANSBAY BRIDGE
San Francisco Board of Engineers
May 1927

This Board, consisting of Robert Ridgway, Arthur N. Talbot, and John D. Galloway, was appointed by the San Francisco Board of Supervisors to clarify the confusion resulting from the 18 franchise applications for private toll crossings between San Francisco and the East Bay filed during 1925 and 1926. Three high level crossings were studied. (See Figure 1).

Location No. 1 extended from Rincon Hill in San Francisco to the Alameda Mole with a vertical clearance of 150 feet carrying four 10-foot highway lanes on the upper deck and three interurban tracks on the lower deck. From Alameda, separate tubes for highway and railway carried traffic under the Oakland Estuary into Oakland.

Location No. 2 extended from Potrero Point in San Francisco to the Alameda Mole with a vertical clearance of 150 feet, carrying the same lane arrangement as Location No. 1 and crossing the Oakland Estuary similarly to Location No. 1.

Location No. 3 extended from Telegraph Hill in San Francisco to Yerba Buena Island with a vertical clearance of 220 feet, then to the Key Mole with a clearance of 135 feet. The type of bridge was not considered for this location.

The Report's Conclusion: Location No. 1 was preferred.

Present Comments: The Locations Nos. 1 and 2 now traverse the Alameda Naval Air Station and Location No. 3 still has most of the disadvantages which the Board of Engineers then stated as follows:

1. The bridgehead on Telegraph Hill is in a region of steep narrow streets and an expensive distribution system would be required.

2. Telegraph Hill is in the northeastern section of the City and a large portion of traffic would have to pass through the business section to reach the bridge.

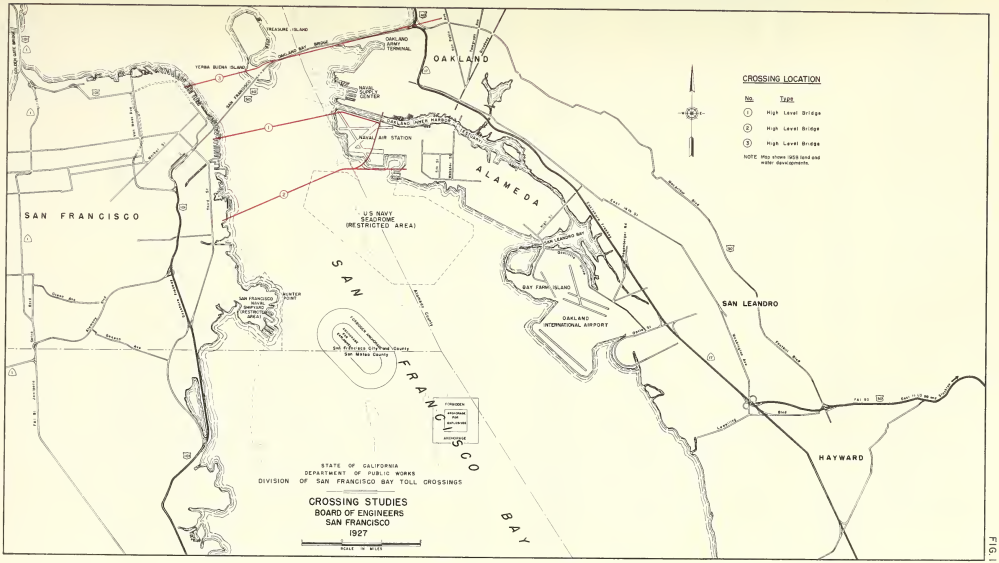

CROSSING LOCATION
No. Type
1 High Level Bridge
2 High Level Bridge
3 High Level Bridge
NOTE Map shows 1928 land and water developments.
SAN FRANCISCO
OAKLAND
ALAMEDA
SAN LEANDRO
HAYWARD
YERBA BUENA ISLAND
TREASURE ISLAND
OAKLAND ARMY BASE TERMINAL
NAVAL AIR STATION
U.S. NAVY SEAPLANE (RESTRICTED AREA)
BAY FARM ISLAND
OAKLAND INTERNATIONAL AIRPORT
SAN FRANCISCO BAY
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS
CROSSING STUDIES
BOARD OF ENGINEERS
SAN FRANCISCO
1927

FIG. 1

3. The land values around Telegraph Hill are high.

4. Borings indicated that bridge piers for the West Bay crossing would have to go to unprecedented depths to reach bedrock.

SAN FRANCISCO BAY BRIDGE
Hoover-Young San Francisco Bay Bridge Commission
August 1930

The nine-man Commission was appinted jointly by President Herbert Hoover and Governor C. C. Young. To reconcile the War Department policy and national defense requirements with the transportation needs and peacetime economy of the area, both military and civilian representatives were appointed. Five locations and a tube were considered. (See Figure 2).

Locations Nos. 1, 2, and 3 were the same alignments as considered by the San Francisco Board of Engineers; however, different lane arrangements and clearances were studied.

Location No. 4 extended from Rincon Hill in San Francisco to Yerba Buena Island with a clearance of 214 feet and from Yerba Buena Island to the Key Mole. It was to carry six auto lanes on the upper deck and four interurban tracks on the lower deck. Location No. 4 was recommended as the most direct connection between traffic centers, and due to bedrock being at reasonable depth, gave the most economical solution.

Location No. 5 extended from Hunter Point in San Francisco to Webster Street in Alameda with a clearance of 150 feet with no facilities for trains and four lanes for highway traffic.

A Tube Line carrying six highway lanes was found too costly.

The Report's Conclusions and Recommendations: The traffic needs required a crossing location on a relatively direct line between centers of traffic demand, and that it should carry both automobiles and interurban trains. Location No. 4 was recommended.

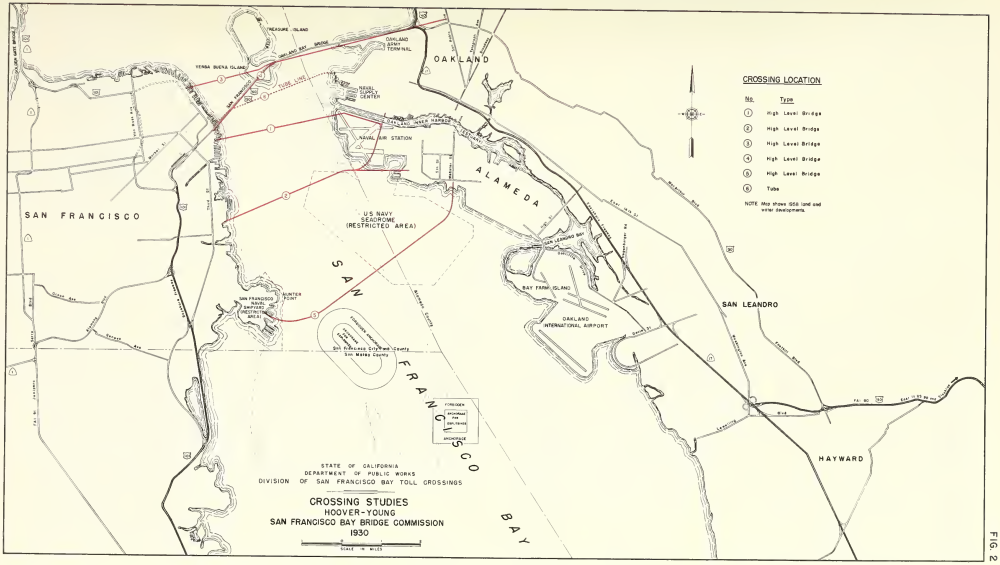

SAN FRANCISCO
OAKLAND
ALAMEDA
SAN LEANDRO
HAYWARD
SAN FRANCISCO BAY
TREASURE ISLAND
YERBA BUENA ISLAND
OAKLAND ARMY TERMINAL
NAVAL SUPPLY CENTER
OAKLAND HARBOR
NAVAL AIR STATION
U.S. NAVY SEAPLANE (RESTRICTED AREA)
SAN LEANDRO BAY
BAY FARM ISLAND
OAKLAND INTERNATIONAL AIRPORT
HUNTER POINT
SAN FRANCISCO NAVAL SHIPYARD (RESTRICTED AREA)
CROCKETT
SAN FRANCISCO-OAKLAND BAY BRIDGE
SAN MATEO-HAYWARD BRIDGE
CROSSING LOCATION
No. Type
1 High Level Bridge
2 High Level Bridge
3 High Level Bridge
4 High Level Bridge
5 High Level Bridge
6 Tube
NOTE Map shows GGS land and water developments.
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS
CROSSING STUDIES
HOOVER-YOUNG
SAN FRANCISCO BAY BRIDGE COMMISSION
1930
SCALE IN MILES

FIG. 2

Present Comments: Statements with reference to Locations Nos. 1, 2, and 3 are essentially the same as in the foregoing report. The existing San Francisco Bay Bridge was constructed approximately on Location No. 4 between 1931 and 1939 with six auto lanes on the upper deck, three truck lanes and two inter-urban tracks on the lower deck. It is now being reconstructed to provide five unidirectional highway lanes for mixed traffic on each deck. The alignment of Location No. 5 did not connect the centers of traffic demand and today traverses both the San Francisco Naval Shipyard and the Alameda Air Station restricted area.

BRIDGE FROM HUNTER POINT TO BAY FARM ISLAND
ACROSS SAN FRANCISCO BAY
Joint Army-Navy Board
July 1941

Pursuant to H. R. 1958, 77th Congress, First Session, the Secretaries of War and the Navy appointed a joint Army-Navy Board to investigate the need and feasibility, from the standpoint of national defense, of constructing a bridge between Hunter Point and Bay Farm Island. The Board consisted of Colonels G. R. Lukesh, CE, USA; W. T. Hanum, CE, USA; and W. A. Johnson, CE, USA; and Captains J. W. Lewis, USN; C. T. Osburn, USN; and H. G. Taylor, CEC, USN. The Board considered two locations. (See Figure 3).

Location No. 1 extended from a point 2,000 feet north of Point Avisadero, on Hunter Point, in San Francisco to Bay Farm Island in Alameda with a high level structure having a vertical clearance of 214 feet. It was to be a double deck structure with four highway lanes on the upper deck, and two lanes for trucks and two main line railroad tracks on the lower deck.

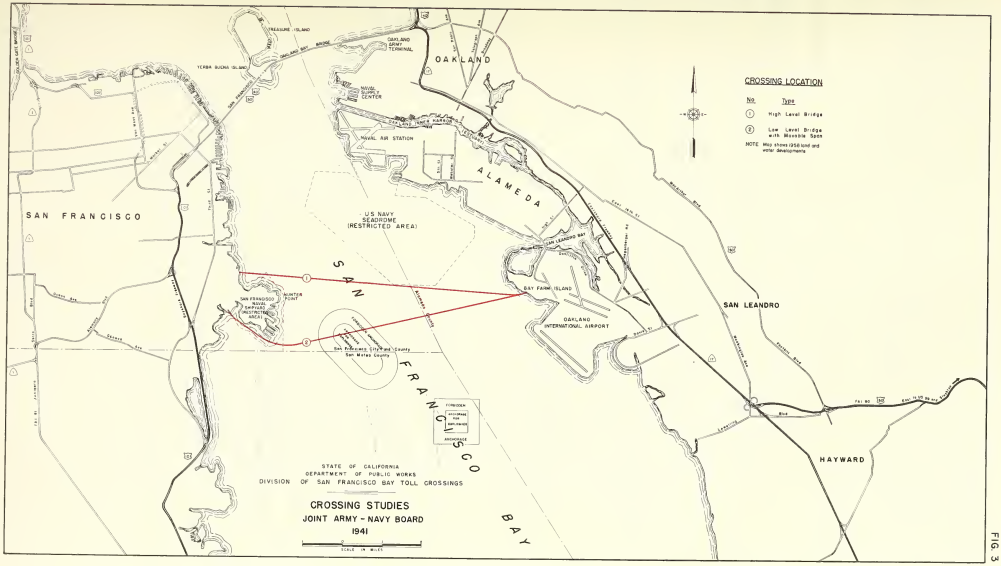

CROSSING LOCATION
No. Type
1 High Level Bridge
2 Low Level Bridge with Movable Span
NOTE Map shows 1956 land and water developments
SAN FRANCISCO
OAKLAND
ALAMEDA
SAN LEANDRO
HAYWARD
SAN FRANCISCO BAY
U.S. NAVY SEADROME (RESTRICTED AREA)
YERBA BUENA ISLAND
TREASURE ISLAND
BAY FARM ISLAND
OAKLAND INTERNATIONAL AIRPORT
NAVAL AIR STATION
OAKLAND ARMY TERMINAL
NAVAL SUPPLY CENTER
SAN FRANCISCO NAVAL SHIPYARD (RESTRICTED AREA)
HUNTER POINT
San Francisco City and County
San Mateo County
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS
CROSSING STUDIES
JOINT ARMY - NAVY BOARD
1941
SCALE IN MILES

FIG. 3

Location No. 2 extended from a point 8,000 feet south of Point Avisadero to Bay Farm Island with a low level structure and lift span. The lift span was to have a vertical clearance of 70 feet when closed and 140 feet when open. It was to be a double deck structure carrying four highway lanes on the upper deck, and two truck lanes and two main line railroad tracks on the lower deck.

The Report's Conclusions: The Board unanimously concluded that from the standpoint of national defense there was no present or immediately prospective need for a bridge across San Francisco Bay between Hunter Point and Bay Farm Island. Such a bridge would adversely affect naval operations and the defense of naval establishments in the vicinity.

Present Comment: Today both locations traverse the San Francisco Naval Shipyard's restricted area.

AN ADDITIONAL CROSSING OF SAN FRANCISCO BAY
Joint Army-Navy Board
January 1947

Pursuant to H. R. 529, 79th Congress, Second Session, the Secretaries of War and the Navy appointed a joint Army and Navy Board consisting of Brig. Gen. G. H. Davidson, AUS; Col. E. H. Marks, CE, USA; Col. Geo. Mayo, CE, USA; and Commodore L. M. Moeller, CEC, USN; Capt. F. C. Fluegel, USN; and Capt. J. E. Baker, USN; to investigate the need and feasibility, from the standpoint of national defense and the development of the peacetime economy, of constructing a bridge from San Francisco to Bay Farm Island or a system of dams across San Francisco Bay as provided in the so-called Reber Plan.

Twenty-nine plans were presented and discussed at public hearings including the Reber Plan proposing dams across the Bay and several similar variations. Also included were the 10 locations being studied concurrently by the California Department of Public Works for its report of 1947.

The governing criteria used in choice of locations for detailed study were that the location should:

1. Serve the present traffic pattern reasonably well and provide for probable future traffic.
2. Discharge vehicular traffic into areas providing easy rapid dispersion of traffic.
3. Provide minimum interference with national defense.
4. Provide minimum interference with navigation.
5. Consider only the area north of Candlestick Point on the west and Bay Farm Island on the east.
6. Not provide for main line railroad crossings, since the railroads indicated they were unwilling to contribute toward costs incident to provision of such facilities.

The Board reported that the Reber Plan and other similar barrier plans would not meet the governing criteria, would result in dislocation of industry, would be economically infeasible, and would be untenable from the standpoint of navigation and national interest. Furthermore, practically none of the water supply benefits would be realized, channel maintenance would be increased, and extensive expansion of sewage maintenance treatment works would be required.

On the basis of the governing criteria all locations were discarded but four, which were given more detailed consideration. (See Figure 4).

Location No. 1. The North Crossing was a high level bridge from Telegraph Hill in San Francisco to the Key Mole in Oakland via Yerba Buena Island and similar in clearance and structure to the existing San Francisco-Oakland Bay Bridge.

Location No. 2. The Central Crossing was a high level bridge parallel and similar to the existing San Francisco-Oakland Bay Bridge.

Location No. 3. The South Crossing was a causeway and tube from Army Street in San Francisco to Fifth Street in Alameda.

Continuous Tube for transbay rapid transit trains from Howard Street in San Francisco to Seventh Street in Oakland.

The Report's Findings: The detailed study found:

1. The South Crossing would induce 10 percent more traffic than the Central Crossing and the North Crossing would generate no more than the Central Crossing.

2. The percent of existing traffic diverted from the Bay Bridge to the three locations studied would be:

	North	Central	South
Auto Traffic	28%	50%	23%
Truck Traffic	15%	50%	29%

3. It would be desirable to take advantage of the undeveloped conditions in the South Bay region now rather than delay until that area becomes more developed.

4. Vehicular crossings should fit a long range plan for the solution of Bay transportation problems.

5. Transbay transportation cannot be solved by continuing indefinitely to add crossings for vehicular traffic alone. An adequate system of cross-bay mass transportation would not only relieve congestion

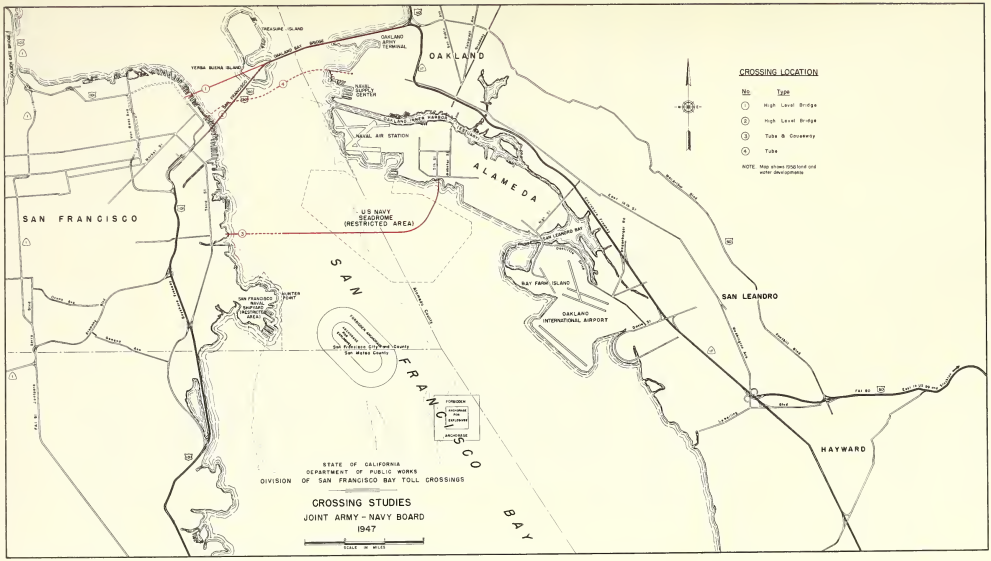

CROSSING LOCATION
No. Type
1 High Level Bridge
2 High Level Bridge
3 Tube & Causeway
4 Tube
NOTE: Map shows 1950 land and water developments
SAN FRANCISCO
OAKLAND
ALAMEDA
SAN LEANDRO
HAYWARD
SAN FRANCISCO BAY
YERBA BUENA ISLAND
TREASURE ISLAND
OAKLAND ARMY TERMINAL
NAVAL SUPPLY CENTER
NAVAL AIR STATION
U.S. NAVY SEADROME (RESTRICTED AREA)
SAN LEANDRO BAY
BAY FARM ISLAND
OAKLAND INTERNATIONAL AIRPORT
SAN FRANCISCO EMBARCADERO FREEWAY (PROPOSED)
SUMNER POINT
San Francisco City and County
San Mateo County
FORBIDDEN AREA
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS
CROSSING STUDIES
JOINT ARMY - NAVY BOARD
1947
SCALE OF MILES

FIG. 4

on vehicular crossings and in the City of San Francisco but would also result in considerable savings of time and money to the commuting public.

The Report's Conclusions: The best solution to the cross-bay transportation problem in its entirety would be a plan combining the existing bridge, a second vehicular crossing, and a system of rapid mass transportation, including a cross-bay subaqueous tube, to provide for all cross-bay traffic over an extended period of years.

The Report's Recommendations:

1. The immediate construction of a six-lane combination causeway-tube from Army Street in San Francisco to Fifth Street in Alameda (Location No. 3).

2. The development of an electric rapid transit system for mass transportation carried across the Bay in a centrally located subaqueous tube.

Present Comments: The vehicular crossing alignment recommended now traverses the restricted area of the Alameda Naval Air Station. The recent Southern Crossing alignment, though calling for the same westerly terminus, had its easterly terminus on Bay Farm Island, a considerable distance south of Fifth Street in Alameda. It was found to be financially infeasible. The tube for mass transit is now being considered by the Bay Area Rapid Transit District whose report is summarized herein.

PRELIMINARY STUDIES FOR AN ADDITIONAL BRIDGE
ACROSS SAN FRANCISCO BAY
Department of Public Works
January 1947

Twelve different proposals, consisting of bridges and tubes across the Bay south of Yerba Buena Island and high

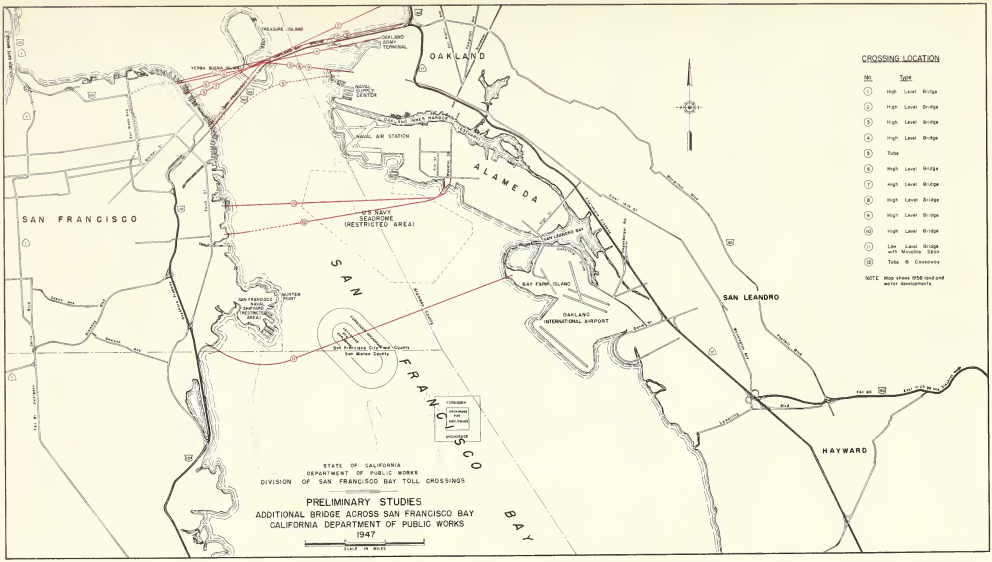

CROSSING LOCATION
No. Type
1 High Level Bridge
2 High Level Bridge
3 High Level Bridge
4 High Level Bridge
5 Tube
6 High Level Bridge
7 High Level Bridge
8 High Level Bridge
9 High Level Bridge
10 High Level Bridge
11 Low Level Bridge with Movable Span
12 Tube & Causeway
NOTE Map shows 1958 land and water developments
SAN FRANCISCO
OAKLAND
ALAMEDA
SAN LEANDRO
HAYWARD
SAN FRANCISCO BAY
TREASURE ISLAND
YERBA BUENA ISLAND
OAKLAND ARMY TERMINAL
NAVAL ELECTRONICS CENTER
OAKLAND INNER HARBOR
NAVAL AIR STATION
U.S. NAVY SEADROME (RESTRICTED AREA)
SAN FRANCISCO INTERNATIONAL AIRPORT RESTRICTED AREA
HUNTER POINT
BAY FARM ISLAND
OAKLAND INTERNATIONAL AIRPORT
San Francisco City and County
San Mateo County
FORBIDDEN ANCHORAGE
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS
PRELIMINARY STUDIES
ADDITIONAL BRIDGE ACROSS SAN FRANCISCO BAY
CALIFORNIA DEPARTMENT OF PUBLIC WORKS
1947
STATE IN MILES

FIG 5

level bridges across the Bay via Yerba Buena Island were studied. Furthermore, while the designated locations which crossed Yerba Buena Island were complete and separate trans-bay crossings, combinations of east- and west-bay locations different from those shown in the study are possible (See Figure 5).

Location No. 1 was the alignment of the existing San Francisco-Oakland Bay Bridge extending from Rincon Hill to Yerba Buena Island and thence to the Key Mole in Oakland.

Location No. 2 extended from Lombard Street on Telegraph Hill to Yerba Buena Island with a four span suspension bridge, then to Stanford Avenue in Emeryville with steel truss and cantilever spans, having either five or six highway lanes on each deck.

Location No. 3 commenced just north of Broadway on Telegraph Hill in San Francisco and extended to Yerba Buena Island with a four span suspension bridge, then to the Oakland Mole with steel truss and cantilever spans. The lane arrangement was to be either five or six highway lanes on each deck.

Location No. 4 followed a line from Lombard Street on Telegraph Hill to Yerba Buena Island with a four-span suspension bridge, then to the Key Mole in Oakland with steel truss and cantilever spans. The bridge was to have either five or six highway lanes on each deck.

Location No. 5 began just east of Fourth Street on Rincon Hill in San Francisco and extended on a 32,800-foot radius curve to the Oakland Mole with two or more subaqueous tubes having two highway lanes per tube or possibly two railroad tracks in one tube, and did not land on Yerba Buena Island.

Location No. 6 extended from Washington Square near Telegraph Hill in San Francisco to Yerba Buena Island with a four-span suspension bridge, then to the Oakland Mole with steel truss and cantilever spans. The bridge was to have either five or six highway lanes on each deck.

Location No. 7 commenced immediately north of Broadway on Telegraph Hill in San Francisco to Yerba Buena Island with either a three- or four-span suspension bridge, then

to the north side of the Key Mole with steel truss and cantilever spans having five highway lanes on the upper deck and either four or five highway lanes on the lower deck.

Location No. 8 extended from Rincon Hill in San Francisco to the Key Mole via Yerba Buena Island with a bridge identical and parallel to the existing San Francisco-Oakland Bay Bridge and located 300 feet north of the latter.

Location No. 9 had the west terminus on Rincon Hill in San Francisco, traversed Yerba Buena Island and terminated at the Oakland Mole. The west-bay bridge was to be a twin of the present San Francisco-Oakland Bay Bridge with steel truss and cantilever spans to the east of Yerba Buena Island having five or six highway lanes on the upper deck and two to five highway lanes on the lower deck.

Location No. 10 reached from Potrero Point in San Francisco to Webster and Sixth Streets in the City of Alameda with a high level steel truss and cantilever span type bridge having four highway lanes on the upper deck and either four highway lanes or two highway lanes and two tracks for steam railroad on the lower deck.

Location No. 11 followed a line from Candlestick Point in San Francisco to Bay Farm Island with low level steel spans and lift span across the navigation channel having four highway lanes on the upper deck and four highway lanes or two highway lanes and two tracks for steam railway on the lower deck.

Location No. 12 extended from Potrero Point in San Francisco to Sixth and Webster Streets in Alameda with a mole, viaduct, tube combination having two lanes in each tube with a total of six or eight highway lanes.

The Report's Conclusions:

Locations via Yerba Buena Island

The two practical west-bay termini from the standpoint of foundation and anchorage conditions are Telegraph Hill and Rincon Hill. Since San Francisco expansion can occur only southward, then the increase in traffic must be southerly. Thus Rincon Hill would better serve traffic needs.

Also, freeway approaches would be less costly and easier to construct to Rincon Hill than to Telegraph Hill.

The three east-bay termini considered were Stanford Avenue, Key Mole, and the Oakland Mole. Termini other than the Key Mole would neither take half the present bridge traffic nor permit operation as two one-way roadways. The Oakland Mole terminus would cross channels leading to the Oakland Harbor which requires a high level structure interfering with normal glide paths of aircraft operating from the Alameda Naval Base.

A terminus on the south side of the Key Mole would cut through the Oakland Port of Embarkation requiring removal of many of the military and harbor improvements.

Therefore, the more feasible east shore terminus appears to be on the Key Mole close to and north of the present Bridge.

South Bay Locations

The cost of the direct San Francisco to Oakland Mole tube crossing (Location No. 5) would be excessive. Location No. 10 interferes with naval and merchant shipping and spans comparable to those on the present bridge would be very costly because of foundation conditions. Location No. 11 involves greater time and distance between present terminals than is now necessary. The four railroad tracks would take up half the bridge and more than double the cost. Location No. 12, a combination tube, viaduct, and mole between Potrero Point and Alameda would be more costly than a high level bridge of equal capacity and would interfere with naval and merchant shipping.

The Report's Recommendation: A second bridge should be built approximately parallel and immediately north of the present Bay Bridge. The advantages of this bridge are:

1. It would afford greatest traffic relief on the present bridge.

2. The cost per additional traffic lane would be less because the location affords the most favorable conditions for pier foundations and methods of construction have been established through experience.

3. Plans for the present bridge could be used with slight modification for many portions of the structure and therefore work could start with a minimum of delay.

4. Administration, operation and maintenance of the second bridge can better be combined with that of the present bridge, thereby resulting in substantial savings.

5. The two parallel east bay crossings could be operated as one-way bridges. The flexibility of multiple parallel roadways across the Bay would facilitate the modifications to meet future traffic needs and changes.

6. Certain duplications of facilities could be avoided.

7. The new structures would present no interference with landing or take-off areas for either land or amphibious aircraft, nor would the glide path for any landing area be obstructed.

8. No additional obstructions would be created for shipping, and no anchorage area would be crossed.

9. It connects directly with the Bayshore Freeway in San Francisco and it terminates at the focal point of East Bay traffic arteries of MacArthur Boulevard and the Eastshore Freeway.

Present Comments: There are both advantages and disadvantages regarding those crossings via Yerba Buena Island. Crossings between the present Bridge and Hunter Point all would interfere with existing military activities except the

tubes which have been shown to be too costly. The crossing south of Hunter Point would probably be acceptable from a military and navigational standpoint.

ADDITIONAL TOLL CROSSINGS OF SAN FRANCISCO BAY
Division of San Francisco Bay Toll Crossings
November 1948

This report pointed out that the Department of Public Works and the Joint Army-Navy Board in their separate investigations in 1947 arrived at the same conclusions on a number of important points concerning a second Bay Crossing as follows:

1. A second Bay Crossing for vehicular traffic is needed at once.

2. Extensive approaches at each end of any structure must be provided as an integral part of that crossing.

3. A second crossing can be financed at this time.

4. The choice for a second Bay Crossing should be limited to a Parallel or a Southern Crossing.

5. A Parallel Bridge will provide more effective and longer lasting relief to the congestion on the existing bridge.

6. The greatest good from a Southern Crossing will be its service to future traffic.

7. Enlargement of transbay mass transportation facilities is not needed at the present time.

8. Main line railroad connections into San Francisco from the East Bay are not financially feasible.

The Department of Public Works in 1947 recommended a Parallel Bridge just north of the existing structure whereas the Joint Army-Navy Board in 1947 recommended construction of a Southern Crossing from Army Street in San Francisco to Fifth

Street in Alameda. Each agency had included the other crossing as part of its study and the respective cost estimates agreed closely. Therefore, the California Toll Bridge Authority resolved that both projects should be constructed. The object of this 1948 report was to determine whether both crossings should be constructed simultaneously, or one at a time, and if the latter, which should be constructed first. (See Figure 6).

Location No. 1. The Parallel Crossing, north of the Bay Bridge, is the same as Location No. 8 in the 1947 report of the Department of Public Works.

Location No. 2. The Southern Crossing is the same as Location No. 3 in 1947 Joint Army-Navy Board report.

The Report's Conclusion: Analyses of costs and revenues showed that only one crossing could be financed at a time and the Parallel Crossing was recommended for the following reasons:

1. A parallel bridge would effectively relieve congestion on the San Francisco-Oakland Bay Bridge until 1970, whereas a Southern Crossing would reduce but not relieve congestion on the existing bridge.

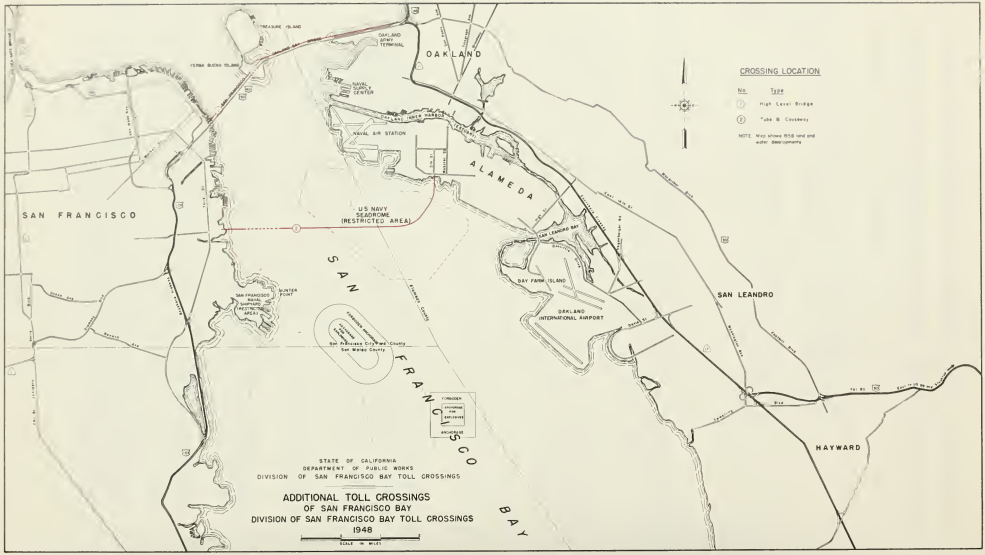
2. Approximately 82 percent of present transbay traffic would be best served by a Parallel Bridge until 1970.

3. Approximately 18 percent of present transbay traffic would be best served by a Southern Crossing.

4. Traffic generated in areas served by the Southern Crossing would increase markedly but would amount to only one percent of the total transbay movement.

5. Extensive approaches have been included for both crossings, thus preventing interference with local traffic and even alleviating local congestion.

FIG 6


OAKLAND
ALAMEDA
SAN FRANCISCO
SAN LEANDRO
HAYWARD
SAN FRANCISCO BAY
TREASURE ISLAND
YERBA BUENA ISLAND
OAKLAND ARMY TERMINAL
NAVAL SUPPLY CENTER
NAVAL AIR STATION
U.S. NAVY SEADROME (RESTRICTED AREA)
BAY FARM ISLAND
OAKLAND INTERNATIONAL AIRPORT
SAN FRANCISCO NAVAL SHIPYARD (RESTRICTED AREA)
HUNTERS POINT
San Francisco City and County
San Mateo County
CROSSING LOCATION
No. Type
7 High Level Bridge
8 Tube & Causeway
NOTE: Map shows fill land and water development
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS
ADDITIONAL TOLL CROSSINGS
OF SAN FRANCISCO BAY
DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS
1948
SCALE IN MILES

Present Comments: At the time of the writing of this report there was no indication that the rails would be removed from the Bridge. Thus the demand for a greater vehicular carrying capacity was of greater importance.

Construction is now under way to increase the capacity of the Bridge from 25 to 35 percent. The effect of this construction, when considered with the proposed plans for doubling the capacity of the San Mateo-Hayward Bridge, makes the necessity for a structure parallel to the existing San Francisco-Oakland Bay Bridge questionable at present and probably for some time in the future.

RELIEF OF CONGESTION OF TRANSBAY CROSSINGS
Assembly Interim Fact Finding Committee
June 1949

Within a month of the California Toll Bridge Authority resolution stating that the Southern Crossing should be built at an undetermined date after completion of the Parallel Bridge, this Committee was formed. Public hearings were held and many proposals for transbay crossings were discussed.

The Report's Conclusions: The Bay Area would be able to have all of the advantages of a Parallel Bridge and Southern Crossing by a three-stage construction program, as follows:

1. Remove the rails and repave the lower deck of the Bay Bridge.
2. Construct a four-lane Southern Crossing.
3. Add four lanes to the upper deck of the Bay Bridge by cantilevering out on both sides.

The Report's Recommendations: The Committee recommended discontinuance of all plans to build a parallel span, and immediate commencement of the three-stage program outlined above.

Present Comments: The Bay Bridge is now being reconstructed to provide five unidirectional traffic lanes on each deck, thus increasing its traffic carrying capacity by 25 to 35 percent. In 1958 the six-lane Southern Crossing from Army Street to Bay Farm Island, designed to meet requirements imposed by the Federal Government in 1953, was found to be financially infeasible.

ADDITIONAL TOLL CROSSINGS OF SAN FRANCISCO BAY AS PROPOSED BY CONSULTANTS TO ASSEMBLY INTERIM COMMITTEE
Division of San Francisco Bay Toll Crossings
October 1949

This Report of the Division of San Francisco Bay Toll Crossings analyzed the report of a Board of Consultants retained by the Assembly Fact Finding Committee on Tideland Reclamation and Development in Northern California, Related Traffic Problems and Relief of Congestion on Transbay Crossings.

The Consultants recommended three stages of development as follows:

1. Replace transbay interurban trains with buses in order to add two traffic lanes to the lower deck which would be used for mixed two-way truck, bus, and auto traffic.

2. Provide a four-lane Southern Crossing along the same alignment proposed by the Joint Army-Navy Board in 1947 (See Location 3, Figure 4).

3. Add cantilever wings to the upper deck of the existing bridge, so that two additional two-lane roadways may be provided for light vehicular traffic in each direction.

The Report's Conclusions: The Division of San Francisco Bay Toll Crossings concluded that the Bay Bridge could be altered to provide for the roadways recommended by the consultants. It would necessitate using open steel grid on the lower deck, which is structurally sufficient; however, it is not popular for general use, particularly for long lengths.

The Consultants' plan would not effectively relieve the growing traffic congestion on the Bridge.

It was concluded that the proposed four-lane Southern Crossing would be adequate for all traffic that would use it by choice. The altered Bridge, however, would again become congested by 1970.

The Committee Consultants' plan offered no solution whatever to the problem of head-on collisions. The central dividing strip on the upper deck, proposed as a part of Stage 3, would give a sense of security to drivers, but would not prevent these accidents, which are primarily due to out-of-control vehicles.

The numerous curves on the upper deck roadway cantilever wings, and the lower standards of decking would provide facilities below the present standards and definitely below the standards that could be provided on a parallel bridge.

In view of these circumstances the recommendation was against the adoption of the Consultants' plan.

Present Comments: The interurban train service on the San Francisco-Oakland Bay Bridfe has been replaced by buses, due to decline of train patronage, and the Bridge is now

being reconstructed as proposed in the first stage of this proposal. Following the paving of the track area, the upper deck will be strengthened to carry heavy commercial vehicles and after completion each deck will accommodate five lanes of unidirectional mixed traffic; thus, the final arrangement with unidirectional traffic will differ from the Consultants' plan and will eliminate head-on collisions.

The Southern Crossing proposed in Stage 2 passes through the Alameda Naval Air Station Seadrome restricted area.

The conclusions regarding Stage 3, as to the addition of cantilever wings on the San Francisco-Oakland Bay Bridge, are still valid conclusions today.

ALTERATIONS AND APPROACHES TO THE SAN FRANCISCO-OAKLAND BAY BRIDGE AS SUGGESTED BY SAN FRANCISCO BAY AREA COUNCIL
Division of San Francisco Bay Toll Crossings
October 1949

The San Francisco Bay Area Council, Inc., suggested to the California Toll Bridge Authority that:

1. Additional approaches to the San Francisco-Oakland Bay Bridge be constructed on the San Francisco side of the Bay, thus providing a better system for the distribution of bridge traffic.

2. An additional tube be constructed between Alameda and Oakland and such other facilities as are necessary to relieve congestion in the vicinity of the Distribution Structure and the Bay Bridve Toll Plaza.

After studying the proposals recommended by the Bay Area Council, the Division of San Francisco Bay Toll Crossings recommended that some of these approaches to the San Francisco-Oakland Bay Bridge should properly be constructed by

the Division of Highways using gas tax money and other portions should be provided from funds and reserves available to the Toll Bridge Authority.

The Division considered that the following specific items of improvement should be paid for from revenue bond funds:

San Francisco Approaches

1. Main and Beale Street Ramps
2. Embarcadero connection south of Market Street
3. Bayshore Freeway between Fourth and Eighth Streets
4. Bridge Ramp between San Francisco Anchorage and Fourth Street

East Bay Approaches

1. Twenty-Second Street Approach
2. Webster Street Tube
3. East Shore Highway north of Distribution Structure

In addition, the Division advocated modification to the Bridge proper so that some of the peak hour auto traffic could be diverted from the upper to the lower deck, though this was not included in the proposal by the San Francisco Bay Area Council. If this were done it would become necessary to add more lanes at the Toll Plaza to handle the increased peak hour traffic capacity of the Bridge.

The Report's Recommendations: It was recommended that the Toll Bridge Authority authorize the immediate improvement of approaches to the existing Bridge and also improvements to increase safety, convenience, and capacity of the Bridge.

Present Comments: Items 1 and 3 of the westerly approaches and Items 1 and 3 of the easterly approaches have been completed with modifications. They were financed entirely by appropriations from the State Highway Fund after

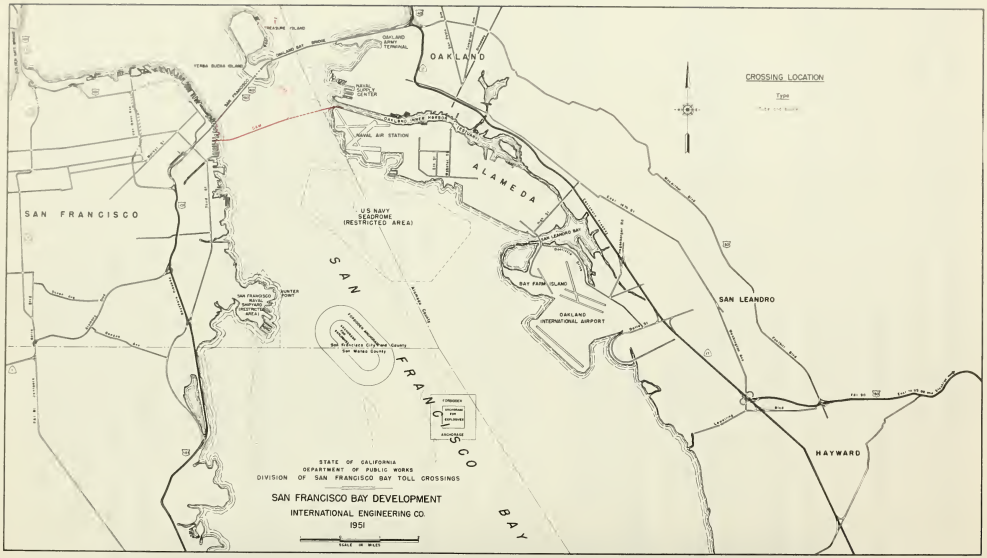

CROSSING LOCATION
Type
OAKLAND
ALAMEDA
SAN FRANCISCO
SAN LEANDRO
HAYWARD
U.S. NAVY SEADROME (RESTRICTED AREA)
OAKLAND INTERNATIONAL AIRPORT
BAY FARM ISLAND
YERBA BUENA ISLAND
TREASURE ISLAND
OAKLAND ARMY TERMINAL
NAVAL AIR STATION
SAN FRANCISCO BAY
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS
SAN FRANCISCO BAY DEVELOPMENT
INTERNATIONAL ENGINEERING CO.
1951

Fig. 7

the California Supreme Court, in California Toll Bridge Authority v. Kuchel, 40 Cal. (2d) 43, held that the California Toll Bridge Authority had no power to issue bonds to finance approaches other than those specified in the original act authorizing construction of the San Francisco-Oakland Bay Bridge.

Item 2 on the east, the Webster Street Tube, is included in the State Highway Budget for 1959-60. Item 4 on the west will be provided in the reconstruction program now under way.

DEVELOPMENT OF SAN FRANCISCO BAY REGION
Assembly Consultants, International Engineering Company, John L. Savage
January 1951

This report studied a system of dams and dikes across San Francisco Bay, a modified Reber Plan, designed to serve many purposes, one of which was transbay transportation (See Figure 7). The transportation aspects of this barrier plan and other barrier plans were studied and reported on by the California Division of Water Resources and summarized herein under BARRIERS IN THE SAN FRANCISCO BAY SYSTEM.

The Report's Conclusions: The Reber Plan is neither functionally nor economically feasible and would seriously hamper the national defense; its costs would exceed the value of its benefits.

A southern barrier might be practicable as a Bay crossing.

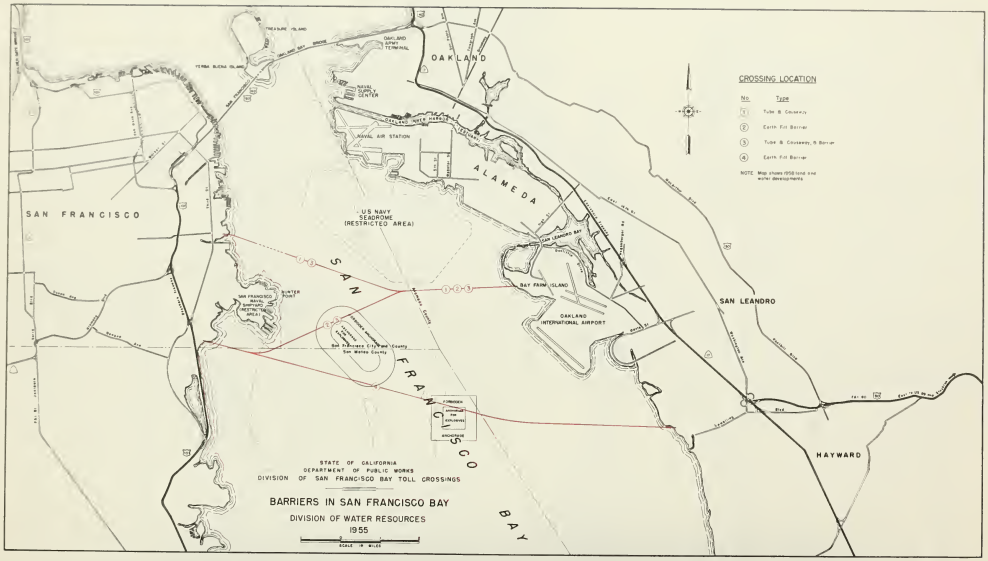

CROSSING LOCATION
No. Type
1 Tube & Causeway
2 Earth Fill Barrier
3 Tube & Causeway, & Barrier
4 Earth Fill Barrier
NOTE Map shows 1958 land and water developments
OAKLAND
ALAMEDA
SAN FRANCISCO
SAN LEANDRO
HAYWARD
BAY FARM ISLAND
OAKLAND INTERNATIONAL AIRPORT
US NAVY SEADROME (RESTRICTED AREA)
SAN FRANCISCO BAY
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS
BARRIERS IN SAN FRANCISCO BAY
DIVISION OF WATER RESOURCES
1955
SCALE IN MILES

FIG 8

As an immediate measure to provide additional capacity on the existing Bay Bridge, alteration of the lower deck offers attractive possibilities.

Present Comments: The first conclusion is still valid. The southern barrier was studied further by the Division of Water Resources whose report follows. The last conclusion is presently being carried out.

BARRIERS IN THE SAN FRANCISCO BAY SYSTEM
Division of Water Resources
March 1955

Several barrier plans were studied, among which were the Reber Plan and the Savage modification.

Among the various uses of transbay earthfill barriers, this study considered the transportation value thereof.

In order to evaluate the utility of a barrier in the south Bay for transportation purposes a consulting transportation engineer was engaged to make comparative traffic movement studies for the following locations: (See Figure 8).

Location No. 1 was the Southern Crossing as authorized by the legislature, and extended from Army Street in San Francisco to Bay Farm Island in Alameda County.

Location No. 2 was a barrier extending from Candlestick Point in San Francisco to Bay Farm Island.

Location No. 3 was a barrier extending from Candlestick Point to a connection with the Southern Crossing 1.1 miles west of Bay Farm Island.

Location No. 4 was a barrier extending from Candlestick Point to Mulford's Landing, near San Lorenzo in Alameda County.

The Report's Findings: The traffic study disclosed that the average daily traffic in 1954 would be distributed as follows:

Distribution of Transbay Trips

(1954 Average Daily Traffic)

Location No.	S. F.-Oak. Bay Bridge	Crossing Studied	San Mateo Bridge
1	68,106	21,980	7,112
2	70,540	19,419	6,728
3	66,975	23,875	6,728
4	78,104	7,225	7,468

In connection with the Candlestick Point Crossing, an additional freeway was considered to exist. This would connect the crossing to the proposed Circumferential Freeway leading to a connection with the Golden Gate Bridge, thus bypassing metropolitan congestion.

Traffic studies indicate the Candlestick Point-Bay Farm Island Crossing warrants further consideration but the Mulford Landing route does not appear justifiable by traffic estimates. For barrier locations north of Hunter Point, other aspects, including that of national defense, would be controlling factors.

The Report's Conclusions: The farther north a new crossing is located the more vehicles it would attract since it would be nearer to the major centers of traffic.

The existance of a barrier would not imply a low cost vehicular crossing. The presence of locks and floodways would require essentially the same bridge superstructure and approaches as over an open waterway. Only if the barrier were sufficiently long to develop the required approach gradient would there be any roadway directly on the barrier fill.

Subaqueous tubes in place of overhead crossing would be considerably more costly.

The Report's Recommendations: No closed barrier should be considered between Chipps Island in the Delta Region and the Golden Gate. Investigation should be made of the feasibility and desirability of partially restricting by a filled causeway the south arm of San Francisco Bay as a means of reducing the existing tidal ranges therein and for use as a trunk transportation facility.

Present Comments: These conclusions and recommendations are receiving further study by other agencies.

SOUTHERN CROSSING OF SAN FRANCISCO BAY
Division of San Francisco Bay Toll Crossings
December 1955

All work by the Division on the Southern and Parallel Crossings was suspended between June 30, 1950, and the Spring of 1954.

In 1953 the State Legislature passed a bill giving priority to the Southern Crossing. Chapter 1056, Statutes of 1953, stipulated the means of obtaining funds and also gave a detailed location of the Crossing and its approaches. The designated termini were Third and Army Streets in San Francisco and Bay Farm Island in Alameda County. This location had not been considered in any previous studies.

Following the enactment of the above legislation in 1953 authorizing engineering studies for a Southern Crossing of San Francisco Bay, two separate reports together

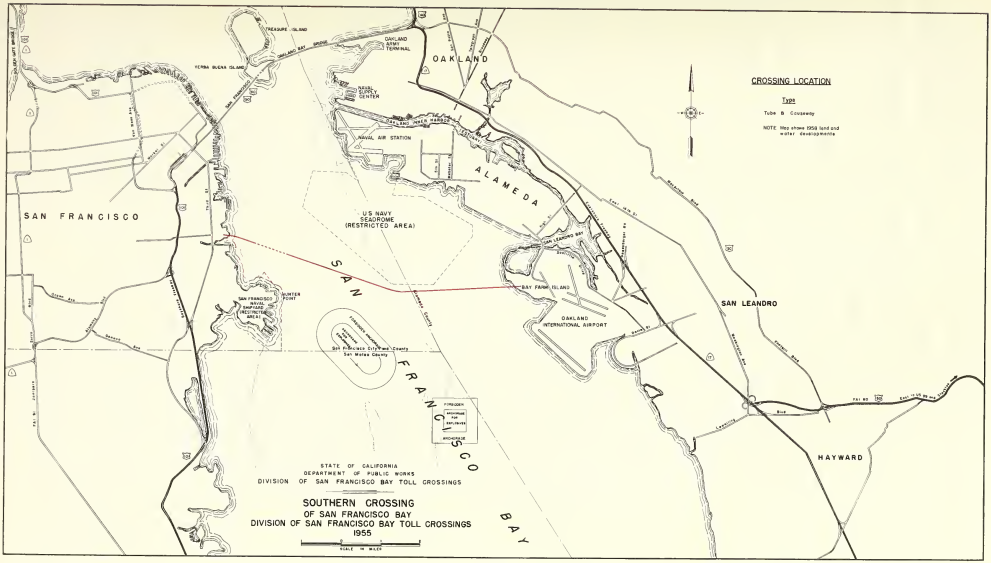
comprising the project report were published by the Division. Due to the limited time remaining in the first year, work was summarized in a brief report called a Progress Report, dated December 1954, followed the next year by the detailed project report, dated December 1955.

Progress Report, December 1954

During 1954 engineering studies and investigations, pursuant to Chapter 1056, Statutes of 1953, for the project were started.

An application was submitted by the Department of Public Works to the U. S. Army Engineers for a permit for construction along the line designated by the legislation, and a public hearing was held by the Corps of Engineers, San Francisco District, on August 17, 1953. At this hearing it developed that the U. S. Navy in connection with its Alameda Naval Air Station had definite plans for extending its seadrome runways to the south, and that the proposed crossing on a direct line between the points designated in the Statutes would interfere with seadrome expansion. Consequently, the application of the Department of Public Works for a crossing on the direct line between Army Street and Bay Farm Island was denied by the Department of the Army on November 3, 1953.

The question then arose as to whether other crossing alignments could be considered under the existing legislation. The Attorney General of the State of California in an opinion published in 22 Ops. Cal. Atty. Gen. 213 advised that the


OAKLAND
ALAMEDA
SAN FRANCISCO
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HAYWARD
SAN FRANCISCO BAY
YERBA BUENA ISLAND
TREASURE ISLAND
OAKLAND INTERNATIONAL TERMINAL
NAVAL AIR STATION
U.S. NAVY SEAPLANE (RESTRICTED AREA)
BAY FARM ISLAND
OAKLAND INTERNATIONAL AIRPORT
SAN FRANCISCO NAVAL SHIPYARD (RESTRICTED)
HUNTER POINT
SAN FRANCISCO CITY AND COUNTY SAN MATEO COUNTY
CROSSING LOCATION
Type
Tube & Causeway
NOTE Map shows 1958 land and water developments
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS
SOUTHERN CROSSING
OF SAN FRANCISCO BAY
DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS
1955
MILES

FIG. 9

California Toll Bridge Authority was to submit a revised application to the Department of the Army for a line swinging several thousand feet south of the direct tangent crossing, thereby avoiding the restricted seadrome area but retaining the same termini as defined in the Statutes. This alignment, plan and elevation met the minimum requirements of the U. S. Navy and an approval of location and plans of bridge was issued by the Corps of Engineers, U. S. Army, (See Figure 9).

Project cost figures, traffic and revenue estimates, and the financial feasibility were not reported upon.

Project Report, December 1955

During 1955 engineering and financial studies were continued. Preliminary plans and cost estimates were made. Traffic and revenue forecasts were obtained.

Conclusions presented were as follows:

1. Although difficult, the project is feasible from an engineering and construction standpoint.

2. The transbay crossing could be opened to traffic in 4-1/2 years after the start of construction and the entire project including approaches could be completed in 5-1/2 years.

3. The project described by the Statutes could be financed with an auto toll of 35 cents on the Southern Crossing and 35 cents on the Bay Bridge.

4. The entire project except the over-water crossing is adaptable to stage construction.

This was intended as the final report prior to offering the bonds for sale and the commencement of construction.

Present Comments: In September 1956 the financial consultants for the Department of Public Works recommended that, should the Authority determine to proceed with the minimum Southern Crossing, provision be made in the authorizing bond resolution for financing the costs of paving the lower deck of the Bay Bridge in the event train service was discontinued even though an increase in tolls above the basic 25-cent rate might be required. The report also recommended that consideration be given to increasing toll rates coincident with the financing of the Southern Crossing.

SOUTHERN CROSSING OF SAN FRANCISCO BAY, SUPPLEMENTARY REPORT
Division of San Francisco Bay Toll Crossings
March 1956

This report summarized engineering and cost studies for proposed changes in the Southern Crossing approach system as outlined in the Assembly Journal for March 23, 1955. These changes were presented as proposed amendments to Assembly Bill No. 3249 (Chapter 304, Statutes of 1955).

Present Comments: These proposed additions and changes were not incorporated in the law since the changes would have increased the amount of money to be borrowed to over $250,000,000 thus necessitating tolls greater than 35 cents on both the Bay Bridge and the Southern Crossing.

SOUTHERN CROSSING OF SAN FRANCISCO BAY
Division of San Francisco Bay Toll Crossings
October 1956

Results of financial studies showed that a bond issue of sufficient amount to construct the entire project as authorized

by the Statutes of 1955 could not be supported by a 25-cent toll on the Bay Bridge and the Southern Crossing. Due to considerable opposition to increasing tolls on the Bay Bridge the Statutes were amended in 1956.

This report summarized engineering and financial studies made as a result of amendments to the Statutes enacted by the Legislature in 1956. The report embraced the following:

1. A summary of project engineering to that date.
2. Revisions to the San Francisco and East Bay approach systems to conform to the amended statutes.
3. Revision of cost, traffic, and revenue estimates.
4. Proposed schedules of financing and construction.

The approach revisions eliminated the Army Street Freeway, rerouted the Embarcadero Freeway from China Basin to Fourth Street, thence down Townsend Street to the Embarcadero, added a route by extending Doolittle Drive to Davis Street and thence to the Eastshore Freeway, and changed the Atlantic Avenue-Main Street Approach in Alameda to a shorter route over Eighth Street.

The Report's Conclusions: It was concluded that the project could be financed with a 35-cent toll on both the Bay Bridge and the Southern Crossing.

Present Comments: It was considered undesirable to raise the tolls on the Bay Bridge above 25 cents.

SOUTHERN CROSSING OF SAN FRANCISCO BAY
Division of San Francisco Bay Toll Crossings
December 1957

Legislation enacted in 1957 modified the Southern Crossing statutes to allow the use of State Highway funds for the construction of certain portions of the approaches. Thus, bond money would only be used for the Minimum Project. This report covers the plans, specifications, and cost estimates for the Minimum Project. The project encompassed the same overwater crossing as shown in Figure 8, but with minimum approaches.

Legislation enacted in 1957 authorized the Department of Public Works to utilize San Francisco-Oakland Bay Bridge revenues for the purpose of altering the Bridge and appurtenances for all vehicular use and the San Francisco Terminal modified for use by motor buses instead of trains. The cost of this project has been estimated at $35,000,000.

The Report's Conclusions: The cost of construction of the complete Southern Crossing is estimated at $249,000,000 and the Minimum Project at $171,000,000. However, since San Francisco-Oakland Bay Bridge revenues are pledged by Statute to construction of the Southern Crossing and reconstruction of the Bay Bridge, revenue bonds must consider the addition of $35,000,000 reconstruction cost.

Present Comments: Section 30660 of the Streets and Highways Code (added by Chapter 2316, Statutes of 1957) provides as follows: "If financing for the construction of a Southern Crossing has not been completed prior to July 1, 1958, all of

the Sections of this article (commencing at Section 30651), except this Section, shall be of no further force or effect."

The necessary financing was not possible by July 1, 1958; therefore, legislation regarding the Southern Crossing from Army Street in San Francisco to Bay Farm Island has lapsed.

RECONSTRUCTION OF THE SAN FRANCISCO-OAKLAND BAY BRIDGE
Division of San Francisco Bay Toll Crossings
March 1957

The San Francisco-Oakland Bay Bridge was constructed with rail facilities for interurban transportation. Three lines used these rails when the Bridge Railway was opened in 1939; Interurban Electric, Sacramento Northern, and Key System. The first two companies abandoned their services shortly thereafter and Key System has since been gradually changing over to buses.

Patronage of the Key trains steadily declined. In 1955 the Key System Transit Lines applied to the Public Utilities Commission for authority to abandon transbay rail service and substitute motor coaches between the East Bay Cities and San Francisco. The financial consultants for the Department of Public Works recommended removal of the interurban rails to improve Bridge revenue.

The Report's Conclusions: Abolishment of rail transportation will increase the number of vehicles using the Bridge; therefore, the space utilized by the tracks must be

converted for use by motor vehicles in order to alleviate critical peak hour congestion.

Present Comments: In view of the foregoing the California Toll Bridge Authority in December 1956 adopted a resolution to finance the necessary reconstruction. Senate Bill No. 1367, Chapter 27, Statutes of 1957, authorized the Department of Public Works to perform all preliminary work. Chapter 2316, Statutes of 1957, directed the Department of Public Works to remove the Bridge Railway when abandonment of train service is ordered by the Public Utilities Commission. In March 1957 the Public Utilities Commission ordered the abandonment of train service over the Bridge and in March 1958 the Commission upheld its order of the previous year after additional hearings were held with regard to reopening the case. The Key trains stopped operating on April 20, 1958. The removal of tracks on the Loop and in the San Francisco Terminal Building commenced immediately. The track area has been paved and buses are now operating through the Terminal.

The completely reconstructed Bay Bridge will have five unidirectional traffic lanes on each deck carrying mixed traffic. The reconstruction will be accomplished over an estimated period of four years at a cost of approximately $35,000,000, to be paid from Bridge's revenues. Reconstruction started in July of 1958.

The traffic carrying capacity will be increased by 25 to 35 percent, and the Bridge will be improved to provide the same standards of construction and safety as are now provided on the freeways it connects on both sides of the Bay.

IMPROVEMENTS TO THE SAN MATEO-HAYWARD BRIDGE
Division of San Francisco Bay Toll Crossings
October 1958

Traffic on the San Mateo-Hayward Bridge has reached such a volume that delays are encountered, consequently, the Legislature in 1957 passed a bill appropriating $200,000 under Chapter 2416, Statutes of 1957, for studies to be made preliminary to the issuance of bonds for improvements to the existing San Mateo-Hayward Bridge or the construction of a new crossing parallel to it so as to at least double the present capacity thereof.

The existing San Mateo-Hayward Bridge is a low level reinforced concrete structure with steel truss spans and a lift span over the navigation channel, carrying two 13.5-foot highway lanes. The Bridge was constructed by private interests and was opened to vehicular traffic in March 1929. This structure and the Dumbarton Bridge were purchased by the State of California in 1951.

The possible alternative methods of increasing the traffic carrying capacity of the Bridge are constructing a bridge parallel to the existing one, double decking the existing structure, constructing an entirely new crossing, or various

combinations of these. In this report six plans were studied with regard to these improvements, together with costs of construction and operation.

The six plans were as follows:

Plan I - A parallel concrete trestle would be built immediately north of and adjacent to the existing facility. After completion of the new trestle the railing on the old structure would be removed making two unidirectional 25-foot roadways separated by a four-foot median strip. The steel truss spans and the lift spans would be double decked.

Plan II - The eastern portion would be the same as Plan I. The western section would be two separate low level concrete trestles with separate steel trusses and lift spans.

Plan III - The eastern portion would be a double decked concrete trestle. The western section the same as Plan II.

Plan IV - This plan except for the transition sections is a double decked structure for its entire length.

Plan V - This would provide a high level crossing over the navigation channel and the removal of the present low level truss and lift spans. The concrete trestle would be similar to that described in Plan I.

Plan VI - This plan is essentially similar to Plan V except that a long span high level cantilever structure is used for the channel crossing.

The Report's Conclusions: The capacity of the Bridge can be more than doubled by the use of Plan I with the lowest overall cost; $25,000,000 for the new construction and a minimum of $18,000,000 for the replacement of the old structure. This complete facility would provide the same standards of construction and safety as are now provided by the freeways it connects on both sides of the Bay.

The Report's Recommendation: The Report recommended that the work required to perform these operations be started as soon as funds are made available.

TRANSBAY TUBE
Consultants for San Francisco Bay Area Rapid Transit District
July 1958

Under the provisions of Chapter 1760, Statutes of 1951, the San Francisco Bay Area Rapid Transit Commission was assigned the responsibility of developing a rapid transit plan adequate to meet the requirements of the San Francisco Bay Area for the foreseeable future.

The Bay Area Rapid Transit Commission report of January 1956 entitled "Regional Rapid Transit" described a network throughout the Bay Area of which a vital link was a transbay subaqueous tube joining Oakland and San Francisco. The technical aspects of this underwater crossing were given in their report of October 1955 entitled "Transbay Tube".

Chapter 1056, Statutes of 1957, created the San Francisco Bay Area Rapid Transit District which published a Supplementary Report on the "Transbay Tube" dated July 1958 (See Figure 10). The primary advantages of the tube propounded in the latter report are:

1. Provides direct, congestion-free, high capacity delivery of passengers to the heart of the region's centers and offers the only economic method by which these areas of commercial concentration may amplify their reception capacity and assure their future stability and growth.

2. Provides a crossing connecting the centers of traffic demand, as does the Bay Bridge, and

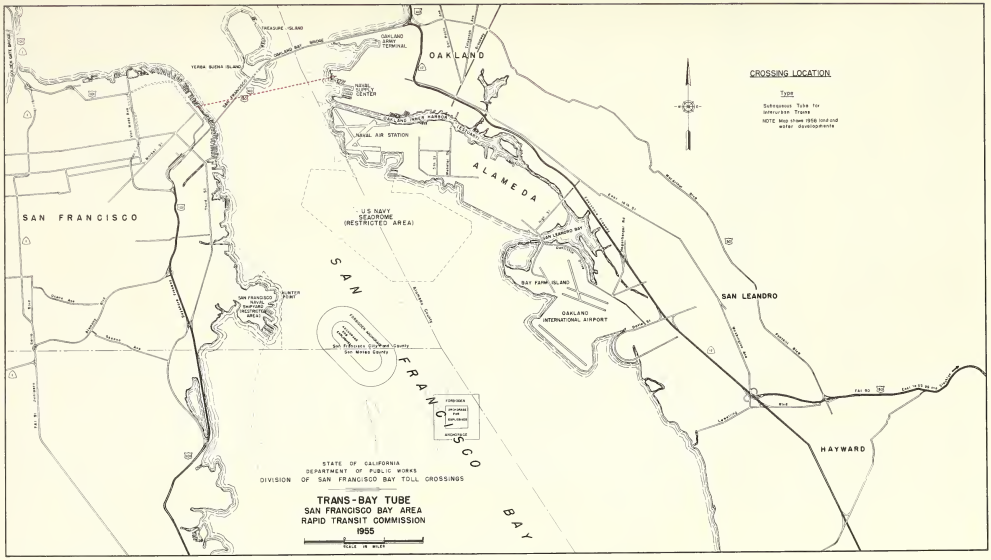

CROSSING LOCATION
Type
Submarine Tube for
Immersed Tube Trains
NOTE Map shows 1958 land and
water developments
OAKLAND
ALAMEDA
SAN FRANCISCO
SAN LEANDRO
HAYWARD
SAN FRANCISCO BAY
U.S. NAVY SEADROME (RESTRICTED AREA)
OAKLAND INTERNATIONAL AIRPORT
BAY FARM ISLAND
TREASURE ISLAND
YERBA BUENA ISLAND
NAVAL AIR STATION
OAKLAND ARMY TERMINAL
SAN FRANCISCO INTERNATIONAL AIRPORT RESTRICTED AREA
WINTER POINT
San Francisco County
San Mateo County
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS
TRANS-BAY TUBE
SAN FRANCISCO BAY AREA
RAPID TRANSIT COMMISSION
1955
SCALE IN MILES

FIG. 10

therefore the tube can effectively relieve peak hour vehicular congestion on the Bay Bridge, which a second vehicular crossing far from centers of traffic demand could not do.

3. Provides additional transbay passenger capacity at much less cost than the second vehicular crossing of the Bay which has been proposed in recent years.

4. Reduces the travel time between downtown Oakland and San Francisco from 43 minutes to 11-1/2 minutes which will produce an aggregate travel time saving of 5,000,000 man hours per year as compared to present forms of transit or auto travel.

The Report's Conclusions: The overall transbay transportation requirements should be resolved in the most economical and efficient manner possible through a balanced combination of modern facilities. The improved vehicular capacity of the reconstructed Bay Bridge is complemented by a high-capacity rapid transit facility designed to meet the great commuting peaks.

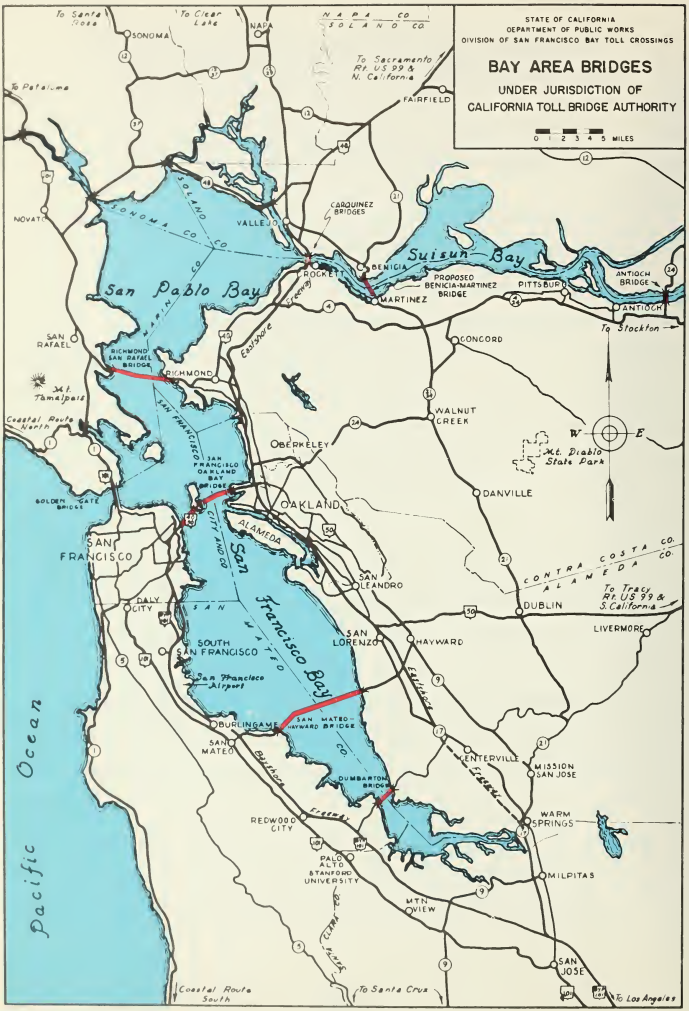
The reconstructed Bay Bridge and a transit tube, serving together can restore and sustain free flowing transportation between East Bay and San Francisco and thus is the best investment for the Bay Area.

Present Comments: The above report was transmitted to the Transit District in July of 1958 and insofar as it is known the District has not adopted the report on any rapid transit plan.

Under these circumstances, it is difficult to evaluate any proposal as to its effect on existing and proposed vehicular facilities, and it is doubtful if State or Federal

legislation would permit State participation. (See Chapter IV, Legal)

FIG. 11


STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS
BAY AREA BRIDGES
UNDER JURISDICTION OF
CALIFORNIA TOLL BRIDGE AUTHORITY
0 1 2 3 4 5 MILES
To Santa Rosa
To Clear Lake
NAPA
SONOMA
NAPA CO.
SOLANO CO.
To Sacramento Rt. US 99 & N. California
FAIRFIELD
To Petaluma
NOVATO
SONOMA CO.
SOLANO CO.
CARQUINEZ BRIDGES
VALLEJO
BENICIA
ROCKET
Suisun Bay
PROPOSED BENICIA-MARTINEZ BRIDGE
PITTSBURG
ANTIOCH BRIDGE
ANTIOCH
To Stockton
MARTINEZ
San Pablo Bay
MARIN CO.
SAN RAFAEL
RICHMOND SAN RAFAEL BRIDGE
RICHMOND
Mt. Tamalpais
Coastal Route North
SAN FRANCISCO BAY
Eastshore Freeway
CONCORD
WALNUT CREEK
Mt. Diablo State Park
W E
BERKELEY
SAN FRANCISCO OAKLAND BAY BRIDGE
OAKLAND
DANVILLE
GOLDEN GATE BRIDGE
SAN FRANCISCO
CITY AND CO.
ALAMEDA
San Francisco Bay
SAN LEANDRO
CONTRA COSTA CO.
ALAMEDA CO.
To Tracy Rt. US 99 & S. California
DALY CITY
SAN MATEO
DUBLIN
SAN LORENZO
HAYWARD
LIVERMORE
SOUTH SAN FRANCISCO
San Francisco Airport
Eastshore Freeway
BURLINGAME
SAN MATEO-HAYWARD BRIDGE
SAN MATEO CO.
CENTERVILLE
MISSION SAN JOSE
Bayshore Freeway
DUMBARTON BRIDGE
WARM SPRINGS
REDWOOD CITY
PALO ALTO STANFORD UNIVERSITY
MILPITAS
MTN. VIEW
Pacific Ocean
Skyline Blvd.
SAN JOSE
Coastal Route South
To Santa Cruz
To Los Angeles

CHAPTER III

PRESENT FINANCIAL STATUS

STATE-OWNED TOLL BRIDGES

There are six crossings within the confines of the San Francisco Bay Areas, as shown on Figure 11 and listed in Table III-1, that are under the jurisdiction of the California Toll Bridge Authority.

TABLE III-1

BAY AREA BRIDGES

Bridge	Opened to Traffic	Comments
Dumbarton	January 15, 1927	Privately financed and constructed. Purchased by the State in September 1951
San Mateo-Hayward	March 3, 1929	Privately financed and constructed. Purchased by the State in September 1951
San Francisco-Oakland Bay	November 12, 1936 (For highway traffic) January 15, 1939 (For interurban rail traffic)	Financed and constructed by the California Toll Bridge Authority
Richmond-San Rafael	September 1, 1956	Financed and constructed by the California Toll Bridge Authority
Existing Carquinez*	May 21, 1927	Privately financed and constructed. Purchased by the State in September 1940
Additional Carquinez*	November 25, 1958	Financed and constructed by the California Toll Bridge Authority
Benicia-Martinez	Possibly by March 1962	To be financed by the California Toll Bridge Authority. Construction possibly to start in April 1959

*Operated as single crossing

As shown in Table III-1 each bridge, except for the Dumbarton and San Mateo-Hayward Bridges, and the new Carquinez and Benicia-Martinez crossings, has been individually financed with repayment of the bonds to be accomplished from tolls obtained from the users of that facility. Additional vehicular crossings of San Francisco Bay will be needed, particularly between the East Bay communities and the City of San Francisco. Additional capacity will be required in the not too distant future between San Francisco and Marin County since the Golden Gate Bridge is rapidly approaching its traffic capacity.

To provide for more efficient toll collection, administration, maintenance, and other economies there appears to be some public sentiment for replacing the outstanding bonds on all State-owned toll bridges with a single revenue bond issue by combining the revenues and reserves of all crossings.

This chapter presents the financial situation of each bridge under the jurisdiction of the Authority and discusses means of placing them under a single revenue bond issue.

PRESENT FINANCIAL STATUS

The California Toll Bridge Authority Act specifically prevents the Authority from levying taxes or assessments to carry out its functions. Therefore, all funds for financing new projects must come from the following sources:

1. Legislative appropriations which in the past have provided funds to perform preliminary engineering investigations on new toll crossings. These appropriations are repaid, with interest, from the sale of the first revenue bonds.

2. Toll Bridge revenue bonds to finance construction of a crossing which are secured and repayable only from tolls collected from the users of the facility.

The following discussion presents data on the current liabilities and assets of these bridges.

Liabilities

The outstanding revenue bonds constitute the major lien against the bridge revenues. As indicated in Table III-2 each bridge was financed, either for construction by the State or for purchase from the private owners, by the issuance of toll revenue bonds. Table III-2 lists the revenue bonds issued for each bridge and Table III-3 presents the amount of these bonds, together with other loans, that are still outstanding.

TABLE III-2

REVENUE BONDS - BAY AREA BRIDGES

Bridge	Amount of Bonds (1000's) Authorized	Issued	Issued Sept. 1,	Due Sept. 1,
San Mateo-Hayward & Dumbarton	$ 8,350	$ 8,350	1951	1976
Richmond-San Rafael	72,000	62,000 Series A	1952	1992
Additional Carquinez	80,000	46,000 Series A	1955	1995
Benicia-Martinez		*Authorized		1995
Total	$160,350	$116,350		

*$34,000,000 Series B proposed to be issued in the Spring of 1959

TABLE III-3

OUTSTANDING REVENUE BONDS AND LOANS
As of September 1, 1958

Bridge	Revenue Bonds	Loan	Total
San Mateo-Hayward & Dumbarton	$ 4,149,000	$ None	$ 4,149,000.00
San Francisco-Oakland	None	None	None
Richmond-San Rafael	62,000,000	4,893,768.03	66,893,768.03*
Additional Carquinez	46,000,000	None	46,000,000.00
Benicia-Martinez	None	None	None**
Total	$112,149,000	$4,893,768.03	$117,042,768.03

*Chapter 159, Statutes of 1955, authorized the California Toll Bridge Authority to borrow $6,000,000 from the State School Land Fund for the purpose of completing the lower deck of the Richmond-San Rafael Bridge. The figure in the above table represents the amount, plus interest as of September 30, 1958, expended from this fund.

**$34,000,000 authorized

In addition to the outstanding bonds and loans presented in Table III-3, the revenues of the San Francisco-Oakland Bay Bridge are pledged until July 1, 1961, to pay for its reconstruction to five lanes of unidirectional traffic on each roadway level. It has been estimated that this work will cost approximately $35,000,000.

The following tabulation shows, as of September 1, 1958, the total outstanding revenue obligations of all the toll bridges in the Bay Area under the jurisdiction of the California Toll Bridge Authority.

TABLE III-4

OUTSTANDING REVENUE OBLIGATIONS

Item	Amount
Revenue Bonds and Loans	$117,042,768.03
Reconstruction of Bay Bridge	35,000,000.00
Total	$152,042,768.03

If the Authority approves the plan to double the capacity of the San Mateo-Hayward Bridge, funds in the amount of $20,500,000 would be required for new construction.

If revenue bonds for that purpose were issued, secured by the revenues of the San Mateo-Hayward and Dumbarton Bridges, it would be necessary to call for redemption the presently outstanding San Mateo-Alameda Toll Bridge Revenue Bonds at a cost of $4,149,000, principal and $81,000 premium. If the date of refinancing is to be July 1, 1959, there would be available then for bond redemption the excess of revenues over bond service between September 1, 1958, and July 1, 1959, estimated at $1,050,000, plus the Reserve Fund of $250,000, leaving $2,930,000 to be supplied from the refinancing program. Allowing for the creation of an initial reserve fund of $2,500,000 and for interest during construction less interest earnings on bond proceeds during construction, a total bond issue of $25,000,000 would be necessary.

EXISTING RESERVES

As of September 1, 1958, the Revenue Fund of the San Francisco-Oakland Bay Bridge held cash and investments

amounting to $25,476,468.80, which by legislation could be made available in lieu of a bond issue to finance the proposed improvements to the San Mateo-Hayward Bridge on a loan basis with interest, or as the initial step in a program looking toward the consolidation of toll bridge obligations into a single issue of bonds secured by the revenues of all of the bridges.

FEASIBILITY OF REFINANCING

The bond resolutions relating to the several presently outstanding issues of toll bridge revenue bonds do not contain any provisions which would prevent a refinancing program. All of the bonds are callable at stated premiums, and except for the Carquinez Strait Bridges Toll Bridge Revenue Bonds which are not callable as a whole until September 1, 1961, they may be called at any time. The provisions of the several bond resolutions relative to redemption are described in the following:

San Mateo-Hayward and Dumbarton Bridges

The revenue bonds issued to purchase these two structures from their private owners were titled "San Mateo-Alameda Toll Bridge Revenue Bonds". They were issued on September 1, 1951, and mature 15 years later, on September 1, 1966.

The bonds are now redeemable, either as a whole or in part on any interest payment date, March 1 and September 1 at premiums of one-fourth of one percent on the principal for

each year or fraction thereof from the date of redemption to the date of maturity not exceeding in any case two and one-half percent.

Richmond-San Rafael Bridge

The $62,000,000 of Richmond-San Rafael Bridge Toll Bridge Revenue Bonds, Series A, were issued on September 1, 1952, and will mature on September 1, 1992. They may now be redeemed on any interest payment date as a whole or in part. The redemption price of these bonds is equal to the principal plus the accrued interest and a premium which is shown in Table III-5. The coupon rate for the Series A bonds is three and seven-eighths percent.

TABLE III-5

REDEMPTION PREMIUM - SERIES A BONDS

Premium if Redeemed On or Before March 1

Year	In Whole percent	In Part percent
1958	6-1/2	5
1959	6	5
1960	5-1/2	5
1961	5-1/4	5
1962	5	5
1963 to 1977 incl.	The interest decreased by 1/4% per year to 1-1/4% in 1977.	
1978 to 1982 incl.	1	1
1983 to 1986 incl.	3/4	3/4
1987	1/2	1/2
1988	1/4	1/4
1988 to 1992	par	par

Besides the $62,000,000 issue of Series A bonds there is a loan from the School Land Fund amounting on September 30, 1958, to $4,893,768.03 including interest which was used to complete the lower deck and approaches to this structure. The loan is subordinated to the rights of the holders of the Series A bonds both as to principal and interest but would have to be repaid upon redemption of the Series A bonds by refinancing or otherwise.

Additional Carquinez Bridge

Funds to finance construction of this structure were obtained from the sale of $46,000,000 of Carquinez Strait Bridges Toll Bridge Revenue Bonds, Series A, dated September 1, 1955, and maturing September 1, 1995. They may be redeemed as a whole on any date on and after September 1, 1961, and in part on any interest payment date on and after September 1, 1961. The redemption price is equal to the principal plus accrued interest and the premium which is shown in Table III-6. The coupon rate for the Series A bonds is three and three-quarters percent.

TABLE III-6

REDEMPTION PREMIUM - SERIES A BONDS

Premium Rate if Redeemed On or Before September 1

Year	In Whole or In Part
1967	4 %
1968	3-3/4%
1969 to 1982	The interest decreases by 1/4% per year to reach 1/4% in the year 1982
1982 to 1995	Par

Benicia-Martinez Bridge

Construction of this crossing will be financed at some time in the future from the sale of $34,000,000 of Carquinez Strait Bridges Toll Bridge Revenue Bonds, Series B, which will mature on the same date as the Series A bonds; that is, September 1, 1995.

Provisions with respect to redemption will be the same as for the Series A bonds. The provisions with respect to call premiums will be determined at the time of issuance.

REFINANCING POSSIBILITIES

It appears likely that there would be no difficulty in marketing a sufficient number of refunding bonds secured by the revenues of the San Francisco-Oakland Bay Bridge, the San Mateo-Hayward and Dumbarton Bridges, and the Richmond-San Rafael Bridge to call for redemption the outstanding San Mateo-Alameda Toll Bridge Revenue Bonds and the Richmond-San Rafael Bridge Toll Bridge Revenue Bonds, to repay the loan to the Richmond-San Rafael Bridge from the School Land Fund, to construct other crossings authorized in the Bay Area, and to either provide the funds needed for the improvements to and the replacement of the San Mateo-Hayward Bridge and the reconstruction of the San Francisco-Oakland Bay Bridge or to permit diversions from revenues of the combined projects in stated amounts sufficient to accomplish those purposes. The proceedings relative to the issuance of such refunding bonds could provide for the issuance of additional series of bonds

from time to time subject to an earnings test, and perhaps other conditions, which would be set forth in the original bond resolution.

In a program such as the above, it would be possible on or after September 1, 1961, if deemed financially expedient, to call for redemption all of the Carquinez Strait Bridges Toll Bridge Revenue Bonds then outstanding. It would also be possible, subject to the earnings test limitation, to issue additional series of bonds from time to time for additional crossings of San Francisco Bay or for any other purposes authorized by law and the original bond resolution.

CHAPTER IV

LEGAL

SOUTHERN CROSSING

Section 30660 of the Streets and Highways Code (added by Chapter 2316, Statutes 1957) provides in part as follows:

> "If financing for the construction of the Southern Crossing has not been completed prior to July 1, 1958, all of the sections of this article (commencing at Section 30651), except this section, shall be of no further force or effect, and the Department of Public Works and the California Toll Bridge Authority may exercise all powers and duties under the California Toll Bridge Authority Act (commencing at Section 30000) as if this article had never been enacted."

Since on July 1, 1958, financing of the Southern Crossing as defined in Streets and Highways Code Sections 30651, et seq., had not been completed, the California Toll Bridge Authority may now proceed under its general powers. These powers are enumerated in Chapter 1, Division 17 of the Streets and Highways Code. It is the purpose of this chapter to outline briefly what the Authority's powers with reference to the construction and acquisition of toll facilities are, and to point out those areas in which, in order to implement certain of the suggestions presented elsewhere in this report, legislative action would be required.

GENERAL POWERS of the AUTHORITY and LIMITATIONS THEREON

Section 30100 of the Streets and Highways Code provides:

> "Whenever in the opinion of the authority and of the department it is necessary or desirable so to do,

the authority shall authorize and direct the department to build or acquire for and in the name of the State any or all of the following:

(a) Toll bridges, tubes or other toll highway crossings across water, bays, arms of bays, straits, rivers, and streams in California, both navigable and unnavigable, or across any stream that is a boundary line between California and any other State.

(b) Transportation facilities of any toll bridges or toll highway crossings constructed or acquired or to be constructed or acquired pursuant to this chapter.

(c) Additional transportation facilities connecting or coordinated with any such toll bridge or other highway crossing or the transportation facilities thereon.

The authority may authorize and direct the department to pay for any such construction or acquisition out of any funds provided or made available by this chapter. Whenever a project consists of a tube or tunnel which will accommodate traffic served by a privately owned ferry the authority may acquire such ferry."

Sections 30004 through 30006 define the terms "toll bridge," "transportation facilities," and "additional transportation facilities." The power of the Authority to finance toll crossings must be interpreted in accordance with these definitions, all of which contemplate that a toll bridge or other toll crossing shall be a crossing designed primarily for use by motor vehicles, that transportation facilities, if any, shall be located on a toll crossing and its approaches, and that additional transportation facilities be connected or coordinated with the transportation facilities on such a toll crossing. Under the provisions of the California Toll Bridge Authority Act, the Authority has the power to authorize and to finance the construction of these enumerated facilities at locations recommended by the Department of Public Works.

The Act does not authorize the Authority to construct crossings devoted solely to rapid transit.

Article 5 of the California Toll Bridge Authority Act (Streets and Highways Code sections 30200 - 30243) authorizes the Authority to issue revenue bonds to finance construction or acquisition of toll crossings, transportation facilities and additional transportation facilities. Section 30235 provides that such bonds shall be secured only by the tolls and revenues of the particular toll bridge or highway crossing for which the bonds were issued. Sections 30204.1 - 30205.5, however, make provision for securing the bonds issued to finance an additional crossing by the tolls and revenues of both an existing crossing and the additional crossing. Thus it would appear that the Authority has the power to pledge the revenues of an existing crossing as security for the bonds issued to finance an additional crossing.

The authority to pledge the revenues of an existing bridge appears however to be limited to aiding in the financing of one additional crossing. Thus, if it were desired to put all toll crossings of San Francisco Bay under one bond indenture, enabling legislation would be necessary.

In addition, federal law imposes certain restrictions on the type and number of crossings to be built and financed by a pledge of the revenues of the San Francisco-Oakland Bay Bridge. Public Law 154, 83d Congress, (which amended section 2 of Public Law 695, 71st Congress, giving congressional consent to the construction of the Bay Bridge) provides that tolls

may be collected on the Bridge to aid in financing construction of not to exceed two additional highway crossings of San Francisco Bay and their approaches. The restrictions in the federal law would appear to prohibit a pledge of revenues of the San Francisco-Oakland Bay Bridge to assist in the financing of a rapid transit tube. Further, they would operate to prevent the Authority from putting all toll crossings of San Francisco Bay under one bond indenture as has been suggested elsewhere in this report as a possibility.

Thus changes in the federal law would be necessary either to authorize pledging of Bay Bridge tolls to aid in financing a rapid transit facility or to enable the Authority to put all toll crossings of San Francisco Bay under one bond indenture.

FEDERAL FINANCING

The suggestion has been made that consideration should be given to obtaining federal participation in the cost of a Southern Crossing. Under existing federal law such participation would not be possible since none of the proposed lines is located on a federal aid route, either interstate or otherwise. Further, federal law prohibits use of federal aid funds on any toll facility. Thus, if federal funds were used for crossing construction, the State would be precluded from issuing revenue bonds to finance its share of the cost of the project.

SUMMARY

Federal and State legislation would be required:

1. For the Toll Bridge Authority to construct a facility for the sole use of rapid transit.

2. For the Toll Bridge Authority to place all the Bay Area Toll Bridges under one bond indenture.

Federal law prohibits the use of federal aid funds on any toll facility.

CHAPTER V

COMPETITION OF BAY CROSSINGS

The construction or improvement of one transbay crossing draws traffic away from the other toll crossings adversely affecting their revenue. Therefore, to protect revenue bondholders from loss the Toll Bridge Authority Act states that as long as bonds of any toll bridge are outstanding, there shall not be erected another crossing connecting the lands on both sides of waters spanned by such bridge, within a distance of 10 miles on either side, unless a lesser distance has been specified in the bond resolution. While revenues of individual crossings may be impaired by a new or improved competing facility, the combined revenues of these facilities increase thereby, and at the same time the public is better served. Thus it would be advantageous to combine revenues of those toll bridges that are in direct competition with each other, then eliminate statutory limitations on competing facilities. Construction or improvements can then be undertaken at locations best serving traffic needs and also providing the greatest revenue.

Since a Southern Crossing would probably not provide enough revenue to be self-liquidating the bonds for building such a crossing would need to be supported by the revenues of one or more of the existing bridges. Three alternatives for a revenue base to obtain new money for construction are as follows: combine the revenues of a Southern Crossing and the Bay

Bridge; combine the revenues of the bridges in south San Francisco Bay, since these are directly competing with each other; or combine the revenues of all State-owned Bay Area bridges.

If revenue were capitalized on a basis of four percent interest and a 40 year amortization period, the money available from each of the State-owned toll bridges for new construction or improvements would be as tabulated below:

TABLE V-1

AVAILABLE CAPITAL

Bridges	Revenue (Present or Predicted) (1,000's)	Capital Available (1,000's)	Outstanding Bonds or Loans, Approximate (1,000's)	New Capital Approximate (1,000's)
Carquinez & Benicia	$ 4,000	$ 80,000	$80,000	$ 0
San Mateo & Dumbarton	2,017	40,000	25,000	15,000
San Francisco-Oakland	10,880	217,600	35,000	182,600
Richmond-San Rafael	2,225	44,500	66,000	-21,500

Combining the revenues of the bridges across south San Francisco Bay provides the greatest amount of new capital.

Past origin and destination surveys have shown that most of the transbay traffic would prefer to use the Bay Bridge; consequently, the farther north a new crossing is located:

1. Greater would be the relief for the congested Bay Bridge.

2. Greater would be the traffic volume carried by the new crossing.

3. Lesser would be the traffic diverted from the uncongested San Mateo-Hayward Bridge.

4. Greater would be the combined traffic volume; thus the combined revenue.

These advantages must now, however, be viewed in light of the reconstruction program now under way on the Bay Bridge and the possibility of reconstructing the San Mateo-Hayward Bridge. Either or both of these projects could have an appreciable effect on the selection of a location for a new crossing.

CHAPTER VI

TRAFFIC

HISTORY OF TRANSBAY TRAFFIC

San Francisco-Oakland Bay Bridge

Prior to the opening of the San Francisco-Oakland Bay Bridge to the public, on November 12, 1936, all transbay traffic, including passenger, was transported by ferries.

About six months later, on May 9, 1937, the first passenger buses were placed in operation serving the East Bay communities and this service has now expanded to cover most of the outlying districts requiring public transportation to San Francisco.

At the time the Bridge Railway was opened to rail transportation, on January 15, 1939, three lines utilized these facilities: Interurban Electric, Sacramento Northern, and Key System. The first two abandoned service after two and one-half years of operation due to decreased patronage and loss of revenue, and the latter converted a portion of its passenger transportation operations to motor vehicles, paralleling in some cases the service provided by the transbay electric trains.

Due to the steady decline of rail patronage, the Key System Transit Lines, on January 24, 1955, petitioned the Public Utilities Commission under Application No. 36656 for permission to abandon service on its transbay rail lines.

between points in the cities of Oakland, Berkeley, Emeryville, and Piedmont and the City and County of San Francisco; and the inauguration of motor coach service. (See Figure 12).

In view of the foregoing, the California Toll Bridge Authority, in its meeting of December 12, 1956, passed a motion with respect to the financing of any necessary reconstruction of the San Francisco-Oakland Bay Bridge, contemplating the abandonment of rail service.

Legislation was enacted in 1957, authorizing the expenditure of the sum of $50,000 for a report on ways and means of reconstructing the San Francisco-Oakland Bay Bridge, its approaches, and terminals for all-vehicular use. After presentation of the Division's report of March 1957 on the "Reconstruction of the San Francisco-Oakland Bay Bridge", additional legislation was enacted authorizing the expenditures of Bridge reserves and revenues accummulated over a four-year period to be used for the reconstruction.

Interested parties asked the Public Utilities Commission for a rehearing with regard to its order of March 12, 1957, for Key System to discontinue rail service and substitute motor coaches. Upon conclusion of these hearings, the Commission amended their 1957 decision, however, upholding its previous order authorizing Key System to abandon rail service.

On April 20, 1958, all rail transportation over the Bridge and into the East Bay was discontinued and motor coach service was substituted for the abandoned lines.

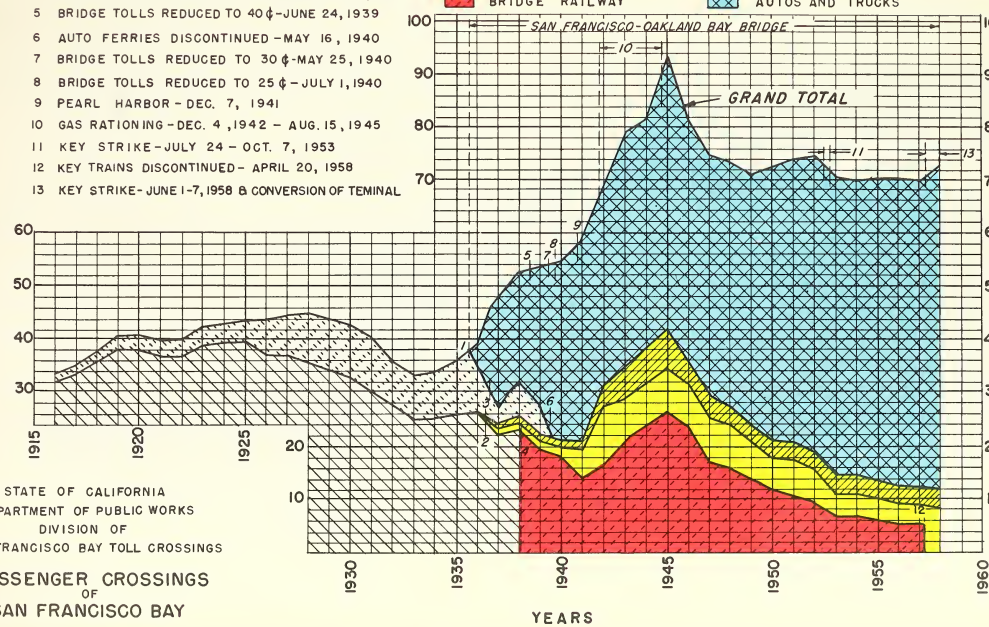

IMPORTANT DATES
1 BRIDGE OPENED – NOV. 12, 1936
2 KEY BUS OPERATION STARTED – MAY 9, 1937
3 AUTO FERRIES REDUCED TO 25¢ – AUG. 15, 1937
4 BRIDGE RAILWAY OPERATION STARTED – JAN. 15, 1939
5 BRIDGE TOLLS REDUCED TO 40¢ – JUNE 24, 1939
6 AUTO FERRIES DISCONTINUED – MAY 16, 1940
7 BRIDGE TOLLS REDUCED TO 30¢ – MAY 25, 1940
8 BRIDGE TOLLS REDUCED TO 25¢ – JULY 1, 1940
9 PEARL HARBOR – DEC. 7, 1941
10 GAS RATIONING – DEC. 4, 1942 – AUG. 15, 1945
11 KEY STRIKE – JULY 24 – OCT. 7, 1953
12 KEY TRAINS DISCONTINUED – APRIL 20, 1958
13 KEY STRIKE – JUNE 1-7, 1958 & CONVERSION OF TEMINAL
LEGEND
PASSENGERS CARRIED BY:
AUTO FERRIES
PASSENGER FERRIES
BRIDGE RAILWAY
KEY BUSES
OTHER BUSES
AUTOS AND TRUCKS
SAN FRANCISCO-OAKLAND BAY BRIDGE
GRAND TOTAL
YEARLY TRANSBAY PASSENGERS IN MILLIONS
YEARS
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF
SAN FRANCISCO BAY TOLL CROSSINGS
PASSENGER CROSSINGS
OF
SAN FRANCISCO BAY

FIG. 12

Work in connection with the reconstruction of the Bay Bridge for one-way vehicular traffic on each deck, the construction of new approaches, and the conversion of the Transbay Transit Terminal from train to bus operation was started as soon as funds were made available, in July of 1957.

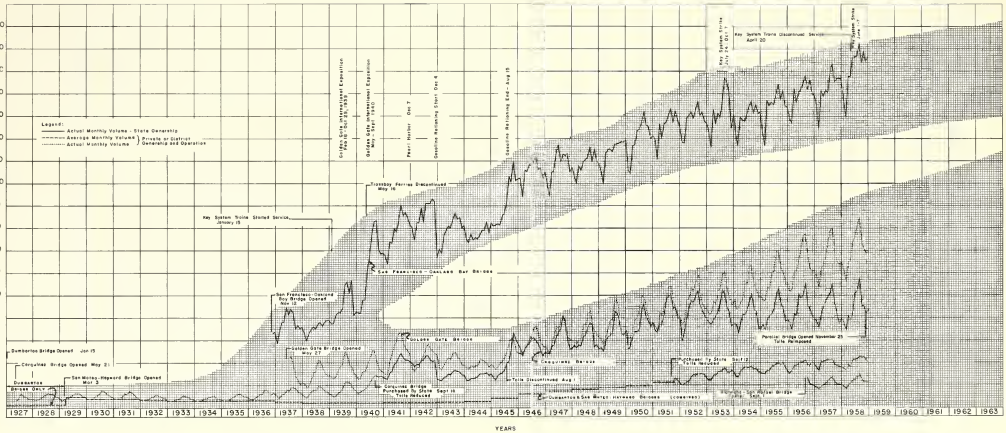
It has been estimated that the present traffic carrying capacity of the Bay Bridge can be increased from 25 to 35 percent and that the reconstructed facility will not reach its present congestion until the year 1972.

A development of regional mass rapid transit facilities throughout the Bay Area, such as may result from the activities of the recently organized Bay Area Rapid Transit District would relieve the Bridge of an estimated 6.9 percent of its passenger cars.

San Mateo-Hayward Bridge

The San Mateo-Hayward Bridge, which crosses the southern end of San Francisco Bay, is located approximately 17 miles south of the San Francisco-Oakland Bay Bridge and 8-1/2 miles to the north of the Dumbarton Bridge. This structure is a part of State Highway Route No. 105 which passes through the cities of San Mateo on the west side of the Bay and Hayward on the east.

The two southern bridges were constructed as private ventures in the twenties and in 1951 a resolution of the California Toll Bridge Authority authorized the purchase of these two structures for an amount of $8,350,000.


VEHICLES - IN THOUSANDS
YEARS
Legend:
Actual Monthly Volume - State Ownership
Average Monthly Volume
Actual Monthly Volume
Private or District Ownership and Operation
Golden Gate International Exposition San Francisco
Golden Gate International Exposition San Francisco
Peak Period
Gasoline Rationing Start Dec 8
Gasoline Rationing End - Aug 15
Key System Trains Discontinued Service April 20
Key System Strike July 5 to Oct 1
Key System Trains Discontinued Service
Key System Trains Discontinued Service May 16
Key System Trains Started Service January 15
San Francisco - Oakland Bay Bridge
San Francisco-Oakland Bay Bridge Opened Nov 12
Golden Gate Bridge
Golden Gate Bridge Opened May 27
Dumbarton Bridge Opened Jan 15
Carquinez Bridge Opened May 2
San Mateo-Hayward Bridge Opened Mar 3
Benicia-Martinez Bridge Opened Oct 16
Carquinez Bridge
Dumbarton Bridge
San Mateo-Hayward Bridge
Benicia-Martinez Bridge
Richmond-San Rafael Bridge
Richmond-San Rafael Bridge Opened July 30
Richmond-San Rafael Bridge
Benicia-Martinez Bridge
Carquinez Bridge
Dumbarton Bridge
San Mateo-Hayward Bridge
Golden Gate Bridge
San Francisco-Oakland Bay Bridge
Ferries Only
Ferries Only
Ferries Only

The volume of traffic using these two bridges remained somewhat constant until the end of World War II, and since that time has steadily increased to such an extent that delays in crossing are now experienced by users of the San Mateo-Hayward Bridge. In 1957 legislation was enacted authorizing engineering studies to be made for improvements to the existing San Mateo-Hayward Bridge or the construction of a new crossing parallel to it so as to at least double its present capacity.

The Division's report of October 1958 on "Improvements to the San Mateo-Hayward Bridge" has suggested ways and means of accomplishing these improvements.

It has been estimated that the present congested traffic capacity of 3,500,000 vehicles a year on the two-lane structure can be increased to 18,000,000 vehicles with a four-lane divided highway, and that the traffic will not reach this maximum capacity until 1998.

Dumbarton Bridge

This structure is another two-lane toll bridge at the southermost end of San Francisco Bay connecting Palo Alto and the Bayshore Freeway on the west side of the Bay with the Eastshore Freeway near Newark, on the east.

Since being acquired by the State in 1951 both bridges have operated as a joint venture. Any financing for improvements to one must necessarily involve the security of the other as the two structures are within a relatively short

distance of each other and derive their traffic from the same sources. If this were not done, either one or the other could conceivably become toll free, thus creating an unsound competitive situation detrimental to favorable financing of either one.

The present traffic on the two-lane Dumbarton Bridge is 1,700,000 vehicles a year. The structure has an ultimate estimated capacity of 5,000,000 vehicles. This volume will not be reached until the year 1987. The proposed improvements to the San Mateo-Hayward Bridge would divert an estimated 16 percent of vehicles from the Dumbarton Bridge; however, the traffic diverted from this facility would not affect the aggregate revenues as the resources of both Bridges would be pooled.

Southern Crossing

A crossing of the Bay at a location between the Bay Bridge and the San Mateo-Hayward Bridge has been advocated since the 1947 Joint Army-Navy Report.

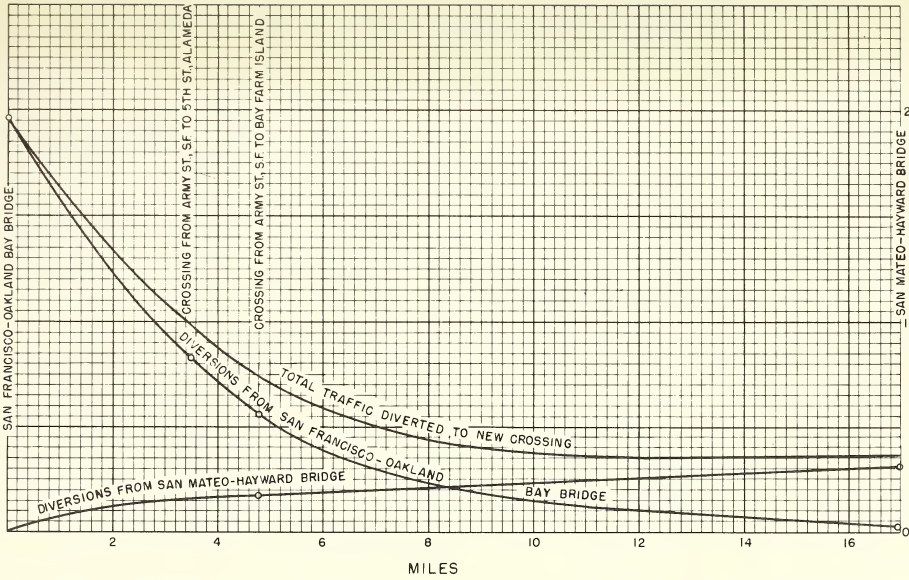
The sources of traffic for a southern crossing would be that traffic diverted from the Bay Bridge, the San Mateo-Hayward Bridge, and the Dumbarton Bridge, plus such traffic as may be induced either because of a new facility serving areas not now adequately served by the existing Bridges or stimulated by relief from existing congestion on the Bay Bridge. In order to determine the magnitude of the traffic that would be diverted from the existing Bridges to the Southern Crossing

from Army Street in San Francisco to Bay Farm Island, origin and destination surveys were conducted in 1957 at the Dumbarton, San Mateo-Hayward, and the San Francisco-Oakland Bay Bridges toll plazas for five day periods. These counts were expanded to annual figures.

The method of allocating vehicles between the competitive bridges and the Southern Crossing was based on time and distance required in traveling the various possible routes. Also, the differences in toll rates were considered in the diversions of vehicles to the Southern Crossing from the competitive crossings. From this survey the traffic consultants estimated that the Southern Crossing from Third and Army Streets, San Francisco, to Bay Farm Island, would divert 43.6 percent of the traffic from the San Mateo-Hayward Bridge if left "as is" and 40.0 percent if reconstructed; 14.4 percent would be diverted from the reconstructed Bay Bridge and 11 percent from the Dumbarton Bridge.

Since a bridge built adjacent to any existing crossing would obviously divert 50 percent of the traffic from that structure, while at the same time causing very little diversion from another distant crossing, it is possible to draw a graphical illustration of the traffic diverted from either existing crossing by any new bridge located at an intermediate point between the two. Such a curve is shown in Figure 14.

As can be seen from Figure 14, the closer the new crossing is to the Bay Bridge the greater will be the relief of



TRAFFIC DIVERTED BY NEW CROSSING
IN 1964

FIG. 14

congestion afforded to the latter. Also, since the Bay Bridge carries approximately 10 times the traffic volume carried by the San Mateo-Hayward Bridge, the closer the new crossing is to the Bay Bridge the greater would be the traffic volume carried by the new crossing.

TRAFFIC DEMAND

It is known that the center of traffic demand is not necessarily coincident with the center of population. For instance, in the east bay region the center of population would vary depending on the area considered tributary to the transbay traffic. Therefore, center of population is not a useful indicator. On the west side of the Bay, the Bay itself defines the tributary area and the center of population obviously must move south since the northerly tip of the peninsula is already densely populated. The center of traffic demand on the west bay side must also move south.

From previous and recent traffic surveys, the pattern of transbay traffic has been obtained and the centers of traffic demand have been plotted.

The center of traffic demand in San Francisco at the time of the Hoover-Young Report in 1930 was at the Civic Center. In 1947 the center had moved three quarters of a mile directly south and in 1957 had moved to a point one and three-fourth miles south of the Civic Center.

The center of traffic demand on the east side of the Bay at the time of the Hoover-Young Report in 1930 was located

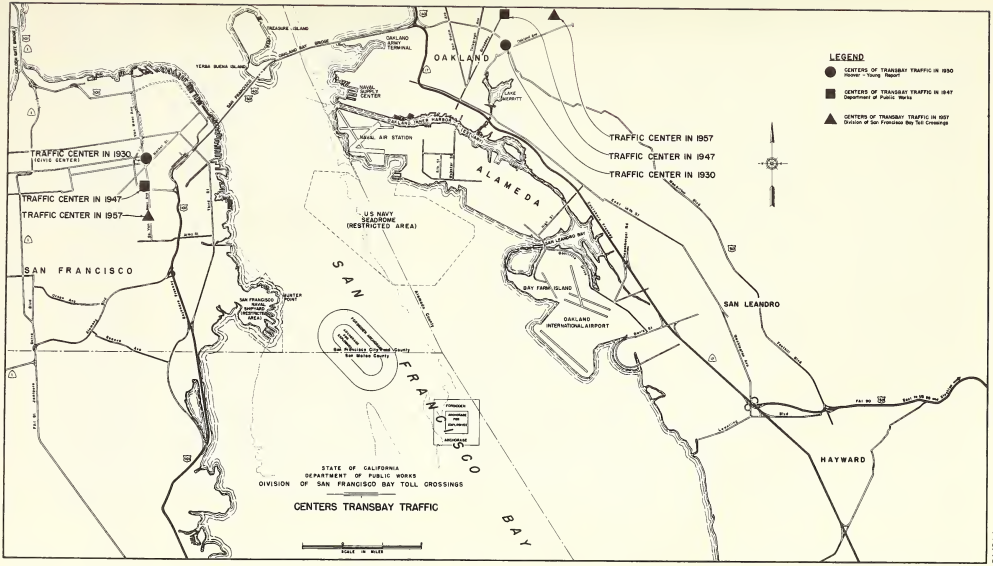

LEGEND
CENTERS OF TRANSBAY TRAFFIC IN 1930
Hoover - Young Report
CENTERS OF TRANSBAY TRAFFIC IN 1947
Department of Public Works
CENTERS OF TRANSBAY TRAFFIC IN 1957
Division of San Francisco Bay Toll Crossings
TRAFFIC CENTER IN 1957
TRAFFIC CENTER IN 1947
TRAFFIC CENTER IN 1930
TRAFFIC CENTER IN 1930
(CIVIC CENTER)
TRAFFIC CENTER IN 1947
TRAFFIC CENTER IN 1957
SAN FRANCISCO
OAKLAND
ALAMEDA
SAN LEANDRO
HAYWARD
TREASURE ISLAND
YERBA BUENA ISLAND
OAKLAND ARMY TERMINAL
NAVAL SUPPLY CENTER
LAKE MERRITT
NAVAL AIR STATION
U.S. NAVY SEADROME (RESTRICTED AREA)
SAN FRANCISCO BAY
BAY FARM ISLAND
OAKLAND INTERNATIONAL AIRPORT
SAN FRANCISCO MUNICIPAL RECREATIONAL PIER
HUNTER POINT
SAN FRANCISCO BAY
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS
CENTERS TRANSBAY TRAFFIC
SCALE IN MILES

FIG. 15

about one mile north of Lake Merritt in Oakland. In 1947 the center had moved to a point two miles north of Lake Merritt, and in 1957 the center had moved slightly east but neither north nor south of the point found in 1947.

It is interesting to note that these centers have not moved an appreciable distance in the last 30 years. This is due to the fact that commerce, industry, and housing concentrate along existing transportation routes. The former ferry system followed by the Bay Bridge caused development to occur at their termini. This development represents a tremendous investment in improvements and these centers would probably remain where they are now regardless of the location of any other crossing.

A new traffic artery should connect centers of demand as closely as practicable.

SUMMARY

1. A southern crossing from Army Street to Bay Farm Island would divert 14.4 percent of the traffic from the Bay Bridge, whereas a crossing located adjacent to the existing Bridge would divert 50 percent. Therefore, the closer to the Bay Bridge that a new crossing is located the greater will be the relief provided for that Bridge.

2. The centers of traffic demand have moved slightly south on the west side of the Bay and slightly northeast on the east side. However, the location is still not far from the centers determined in 1930.

3. Large concentrations of industry, commerce, and residential growth have developed along existing transportation routes; originally the ferries and later the San Francisco-Oakland Bay Bridge. These represent tremendous investment in facilities

which would remain essentially where they are now located even though a Southern Crossing were built. Since these concentrations of commerce are the generators of traffic, the majority of the trans-bay traffic would still be generated in regions now served by the Bay Bridge.

SOURCES OF INFORMATION

Information regarding the volume of transbay traffic and its distribution comes from the following sources:

1. The volumes of past and present transbay vehicular traffic carried by the Bay Bridge, the San Mateo-Hayward and Dumbarton Bridges are available from the Bridge records.

2. The results of origin and destination surveys, conducted in September 1957, of traffic using the Bay Bridge, the San Mateo-Hayward and Dumbarton Bridges.

3. The results of origin and destination surveys made during 1946 and 1947 by the Bay Area Metropolitan Traffic Survey in cooperation with the United States Bureau of Public Roads and the "Traffic Report, San Francisco Bay Metropolitan Area" and "Map Exhibits" thereto, prepared by District IV, California Division of Highways, and published in June 1949.

4. Basic interview data relating to origins and destinations of transbay passenger vehicles obtained by the Consulting Engineers to the San Francisco Bay Area Rapid Transit Commission during the spring of 1954.

5. The results of a survey of origins and destinations of trucks crossing the Bay Bridge and the San Mateo-Hayward Bridge made during March 1955, made by the San Francisco-Oakland Bay Bridge under the supervision of Coverdale & Colpitts.

6. Traffic and operating records of the Golden Gate Bridge.

7. Report entitled "Regional Rapid Transit" prepared for the San Francisco Bay Area Rapid Transit Commission by Parsons, Brinkerhoff, Hall, and Macdonald, dated January 3, 1956.

8. The results of previous studies by Coverdale & Colpitts, including those for the Bay Bridge in 1936 and subsequent years; the Richmond-San Rafael Bridge, 1951 and subsequent years; the Carquinez Bridge, 1955; operations of the Bridge Railway, 1953; and estimated traffic and earnings of the Southern Crossing and San Francisco-Oakland Bay Bridge, November 1, 1955; and the supplement thereto dated October 1956.

9. Statistical information related to past, present, and prospective development of the Bay Area, both that contained in fundamental publications of the United States Bureau of the Census and those provided by other public and private agencies.

10. Time and distance information on all principal routes on both sides of the Bay obtained in 1957 by Coverdale & Colpitts taken both during peak and off-peak hours.

CHAPTER VII

CONCLUSIONS

The development of many military, industrial and commerical facilities on both shores of San Francisco Bay since World War II and the enlargement of some of the older enterprises in later years leave few undeveloped areas available for a south Bay Crossing and connecting approach freeways.

The existing eight mile restriction for a competing structure in the vicinity of the San Mateo-Hayward Bridge definitely limits the southerly location of a new Southern Crossing; however, any refinancing and combining of this facility with a new crossing could avoid this restriction.

The various restricted areas, forbidden anchorages, proposed and established industrial sites are shown on Figure 16. Not shown are the extended glide paths for the three air fields which would restrict the height of any proposed structure, or tentative proposals for such developments as fresh water lakes, recreational areas, and rapid transit installations on the land areas on both sides of the Bay.

The conclusions of this study are summarized as follows:

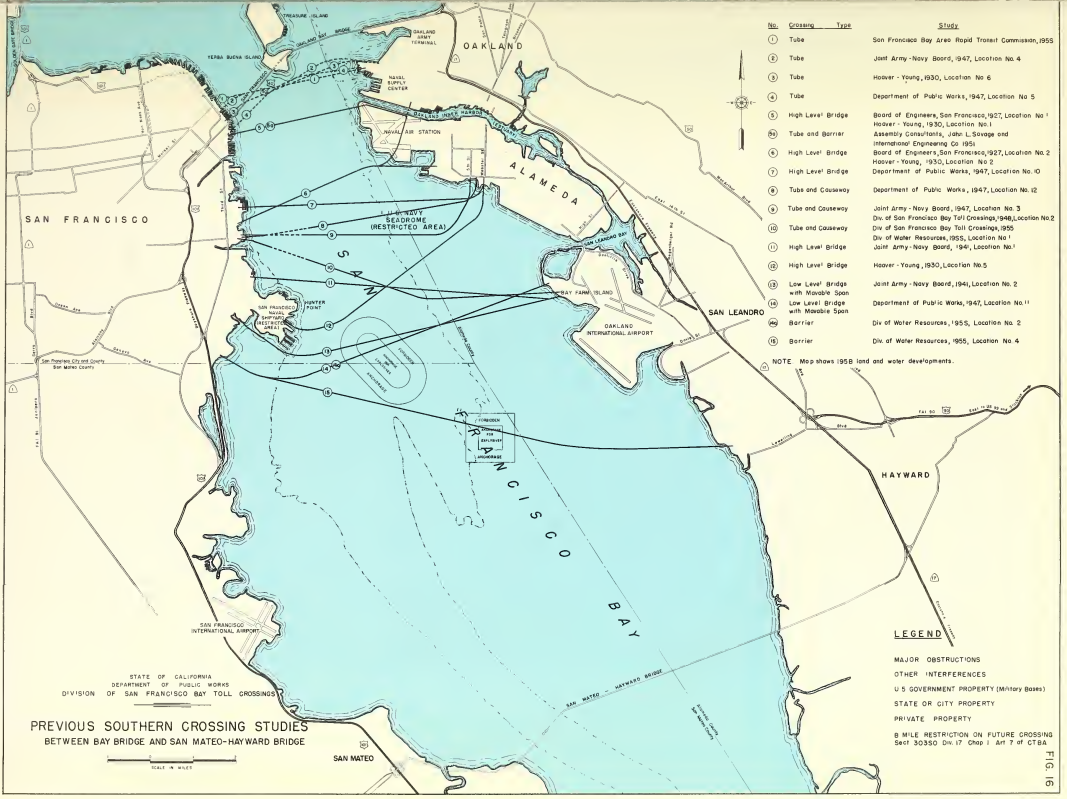
1. Reconstruction of the San Francisco-Oakland Bay Bridge will add from 25 to 35 percent to its traffic carrying capacity.

2. Although origin and destination surveys show that most of the transbay traffic would prefer to use the San Francisco-Oakland Bay Bridge, traffic predictions indicate that the Bay Bridge, when altered to an all vehicular structure with one way traffic on each deck, will not again reach its present congestion until 1972.

Location No.	Study	Crossing Description	Remarks
1	San Francisco Bay Area Rapid Transit Commission	Continuous tube with two tracks for interurban trains.	Toll Bridge Authority legally empowered to build highway crossings with connecting railways. See Chapter IV for full information.
2	Joint Army - Navy Board, 1947, Location No. 4.	Continuous tube with two tracks for interurban trains.	Toll Bridge Authority legally empowered to build highway crossings with connecting rail facilities. See Chapter IV for full information.
3	Hoover-Young, 1930, Location No. 6.	Continuous tube with six highway lanes.	Too costly.
4	Department of Public Works 1947, Location No. 5.	Continuous tube with four highway lanes and two tracks for interurban trains.	Too costly.
5	Board of Engineers, San Francisco, 1927, Location No. 1. Hoover-Young, 1930, Location No. 1.	High level bridge with four highway lanes and three tracks for interurban trains.	Traverses Alameda Naval Air Station. *
5a	Assembly Consultants, John L. Savage and International Engineering Co.	Tube and barrier with eight highway lanes.	Jeopardize's national defense.
6	Board of Engineers, San Francisco, 1927, Location No. 2. Hoover-Young, 1930 Location No. 2.	High level bridge with four highway lanes and three tracks for interurban trains.	Traverses Alameda Naval Air Station.*
7	Department of Public Works, 1947, Location No. 10.	High level bridge with six highway lanes and two tracks for main line railroads.	Traverses Naval Seadrome Restricted Area. *
8	Department of Public Works, 1947, Location No. 12.	Tube and causeway with six highway lanes.	Traverses Naval Seadrome Restricted Area.*
9	Joint Army - Navy Board, 1947, Location No. 3. Division of San Francisco Bay Toll Crossings, 1948, Location No. 2.	Tube and causeway with six highway lanes.	Traverses Naval Seadrome Restricted Area.*
10	Division of San Francisco Bay Toll Crossings, 1955. Division of Water Resources Location No. 1.	Tube and causeway with six highway lanes.	Financially infeasible.
11	Joint Army - Navy Board, 1941, Location No. 1.	High level bridge with six highway lanes and two tracks for main line railroads.	Adversely affects the defense of naval establishments in the vicinity.
12	Hoover - Young, 1930, Location No. 5.	High level bridge with four highway lanes.	Traverses the San Francisco Naval Shipyard and the Naval Seadrome Restricted Area.*
13	Joint Army - Navy Board, 1941, Location No. 2.	Low level bridge with movable span carrying six highway lanes and two tracks for main line railroads.	Adversely affects the defense of naval establishments in the vicinity.
14	Department of Public Works, 1947, Location No. 11.	Low level bridge with movable span carrying six highway lanes and two tracks for main line railroads.	Distant from centers of traffic demand.
14a	Division of Water Resources Location No. 2.	Barrier with four highway lanes.	Distant from centers of traffic demand.
15	Division of Water Resources Location No. 4.	Barrier with four highway lanes.	Distant from centers of traffic demand.

* During times of emergency, most government establishments are closed to public traffic.

PROPOSED SHIP CHANNEL
PORT OF OAKLAND INDUSTRIAL PARK
REGIONAL STADIUM
PROPOSED INDUSTRIAL DEVELOPMENT
PROPOSED INDUSTRIAL DEVELOPMENT
SAN LEANDRO CREEK
PROPOSED MARINA DEVELOPMENT
INDUSTRIAL AREA
OAKLAND - ALAMEDA
3 MILE STADIUM LIMIT



No.	Crossing	Type	Study
(1)	Tube		San Francisco Bay Area Rapid Transit Commission, 1955
(2)	Tube		Joint Army - Navy Board, 1947, Location No. 4
(3)	Tube		Hoover - Young, 1930, Location No. 6
(4)	Tube		Department of Public Works, 1947, Location No. 5
(5)	High Level Bridge		Board of Engineers, San Francisco, 1927, Location No. 1
(5a)	Tube and Barrier		Hoover - Young, 1930, Location No. 1 Assembly Consultants, John L. Savage and International Engineering Co. 1951
(6)	High Level Bridge		Board of Engineers, San Francisco, 1927, Location No. 2 Hoover - Young, 1930, Location No. 2
(7)	High Level Bridge		Department of Public Works, 1947, Location No. 10
(8)	Tube and Causeway		Department of Public Works, 1947, Location No. 12
(9)	Tube and Causeway		Joint Army - Navy Board, 1947, Location No. 3
(10)	Tube and Causeway		Div. of San Francisco Bay Toll Crossings, 1948, Location No. 2 Div of San Francisco Bay Toll Crossings, 1955
(11)	High Level Bridge		Div. of Water Resources, 1955, Location No. 1 Joint Army - Navy Board, 1949, Location No. 1
(12)	High Level Bridge		Hoover - Young, 1930, Location No. 5
(13)	Low Level Bridge with Movable Span		Joint Army - Navy Board, 1941, Location No. 2
(14)	Low Level Bridge with Movable Span		Department of Public Works, 1947, Location No. 11
(14a)	Barrier		Div of Water Resources, 1955, Location No. 2
(15)	Barrier		Div. of Water Resources, 1955, Location No. 4

NOTE Map shows 1958 land and water developments.

LEGEND

MAJOR OBSTRUCTIONS

OTHER INTERFERENCES

U S GOVERNMENT PROPERTY (Military Bases)

STATE OR CITY PROPERTY

PRIVATE PROPERTY

8 MILE RESTRICTION ON FUTURE CROSSING
Sect 30350 Div. 17 Chap 1 Art 7 of CTBA

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS

PREVIOUS SOUTHERN CROSSING STUDIES
BETWEEN BAY BRIDGE AND SAN MATEO-HAYWARD BRIDGE

SCALE IN MILES

FIG 16

3. The proposed plan for the improvements to the present San Mateo-Hayward Bridge will more than double its present capacity.

4. Estimates of future traffic indicate that a six-lane structure would not be required between San Mateo and Hayward until 1998.

5. Federal and State legislation would be required to place all Bay Area toll crossings under one bond indenture.

6. Federal and State legislation would be required for the State to construct a crossing for the sole use of rapid transit.

7. The reconstruction of the San Francisco-Oakland Bay Bridge and the San Mateo-Hayward Bridge will relieve the present congestion of traffic for the next decade; however, before new developments obstruct the remaining routes, the location of the new crossing should be designated and rights-of-way protected.

8. Funds should be appropriated and work authorized at this time for the preparation of surveys, plans, estimates, the obtaining of traffic and financial studies, and any other work required to determine the most desirable southern crossing location for construction of a crossing at an appropriate time when traffic needs and financial feasibility exist.

9. It is to be noted that a great number of the suggested changes and improvements mentioned in previous reports have been completed during the intervening time to cope with the increased traffic in this area.

Assembly Bill No. 19

CHAPTER 3

An act making funds available for surveys and studies of an additional San Francisco Bay crossing.

[Approved by Governor May 1, 1958. Filed with Secretary of State May 24, 1958.]

The people of the State of California do enact as follows:

SECTION 1. The unexpended balance of the Southern Crossing Engineering Fund shall be available for expenditure by the Department of Public Works for preparation of surveys, plans and estimates, and obtaining traffic and financial studies, and the payment of any other necessary expenses in connection with the financing and construction of an additional toll bridge or other toll highway crossing across the Bay of San Francisco between the County of Alameda on the east side of the Bay and the City and County of San Francisco or the County of San Mateo on the west side of the Bay.

A P P E N D I X B

EXTRACT OF MINUTES OF CALIFORNIA TOLL BRIDGE AUTHORITY MEETING ON APRIL 30, 1958

The following is quoted from the above minutes with reference to Agenda Item No. 4, Discussion of action to be taken in connection with the Southern Crossing.

"The Chairman thereupon returned to Agenda Item No. 4, and asked for discussion.

"Mr. Gilliss said that no resolution had been prepared. His recommendation was that the Authority ask the Department of Public Works to prepare an informational report on all of the studies heretofore made of a southern crossing, by the Department and by others; also on the effect of new developments, military and civic, which might influence the import of the conclusions of these former reports; that it also include a report showing the present financial situation with respect to every bridge under the jurisdiction of the Toll Bridge Authority.

"It was suggested by Mr. Raab that the study should take into consideration, also, the effect of the reconstruction of the San Francisco-Oakland Bay Bridge, and the reconstruction of the San Mateo-Hayward Bridge.

"Mr. Reed pointed out that there was some public sentiment for combining the bond issues now outstanding so as to put the combined earning power of all the bridges back of the construction of any new bridge. Because some of the bond resolutions contained provisions limiting the conditions under

which the bonds might be refinanced, he thought that information should be included in the report.

"The Chairman directed that the report be made up along the lines suggested by Mr. Gilliss, Mr. Raab, and Mr. Reed, and that the information so developed might be released to any public body interested in it."

STATE OF CALIFORNIA

DEPARTMENT OF PUBLIC WORKS

EST. 9015. 71976 3-58 7500 SPO

APPENDIX C

MEMORANDUM

FROM OFFICE OF DIRECTOR

To: Mr. N. C. Raab *Date* October 8, 1958

SUBJECT: Southern Crossing Report

The California Toll Bridge Authority, at its meeting in Sacramento on April 30, 1958, authorized the Department of Public Works to prepare an informational report on all of the studies heretofore made by this Department and by other agencies on a southern crossing of San Francisco Bay, the report to include the effect of new developments in the area, both military and civic, which could influence the import of the conclusions of these former reports.

The work should also include a report showing the present financial situation with respect to every bridge under the jurisdiction of the Toll Bridge Authority. Mr. Reed pointed out at the meeting that there was some public sentiment for combining the bond issues now outstanding so as to put the combined earning power of all the bridges back of the construction of any new bridge.

The Authority also agreed to the suggestion offered by representatives of the San Francisco Bay Area Rapid Transit District that the question of provision for rail rapid transit service, including the building of a tube, would be considered and commented on in the report.

There is submitted herewith a copy of a letter addressed to the Director of Public Works on August 15, 1958 by Mr. John Peirce, General Manager of the San Francisco Bay Area Rapid Transit District, together with copies of a supplemental report on a trans-bay tube, which information you should have before you in preparing your report.

It is suggested that the question of the extent to which Rapid Transit should be considered in your

report should be the subject of a conference with Mr. Reed, Mr. Higgins, the Director, and others, for the purpose of deciding on the policy to be followed.

Enclosed you will find, for your records, a copy of the minutes of the California Toll Bridge Authority Meeting of April 30, 1958.

While it has been informally understood and agreed that this report would be prepared by your Division, the purpose of this Memorandum is to formally assign the responsibility to the Division of San Francisco Bay Toll Crossings.

C. M. GILLISS

Attach.

cc: G. T. McCoy (2)
R. E. Reed
E. R. Higgins